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American Antiquity

A Quarterly Review of American Archaeology

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AMERICAN ANTIQUITY IS INDEXED IN THE INTERNATIONAL INDEX

Published by the

Society for American Archaeology

Vol. X *October, 1944* No. 2

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AMERICAN ANTIQUITY is published at 450–454 Ahnaip Street, Menasha, Wisconsin, quarterly in the months of January, April, July and October by the Society for American Archaeology. Subscription only by membership in the Society for American Archaeology (annual dues $4.00); includes the quarterly issues of AMERICAN ANTIQUITY and other releases as issued.

Entered as second-class matter July 22, 1935, at the post office at Menasha, Wisconsin, under the Act of March 3, 1879.

Contributions and publications for review should be sent to the Editor, Douglas S. Byers.

Subscriptions and orders for back numbers should be addressed to the Treasurer, Frederick Johnson.

Please address all requests for information to the Secretary.

AMERICAN ANTIQUITY

VOL. X OCTOBER, 1944 NO. 2

DATED ESKIMO RUINS OF AN INLAND ZONE

J. L. GIDDINGS, JR.

THE Eskimo culture is divided ecologically, Froelich Rainey says in a review of published accounts,[1] into "the Arctic coastal zone in the area of sea ice" and "the sub-Arctic zone south of the maximum extension of heavy sea ice, in Southern Alaska and Greenland. . . . A third ecologic zone is that region occupied by Eskimo people with an inland form of culture which has been most clearly defined by Kaj Birket-Smith in his description of the Caribou Eskimo of the Barren Grounds northwest of Hudson Bay; *but a similar type of inland Arctic culture occurs also in north Alaska. The prehistory of the inland zone is unknown, since no archaeological research has been carried on in that region.*"[2]

The italicized lines point to a vast gap in knowledge of the Eskimo past. The inland zone remains largely unknown because of two handicaps to archaeological exploration: the nomadic nature of any far-inland hunting culture about the Arctic Circle precludes the possibility of large and permanent villages, and organic materials disintegrate rapidly under the climatic contrasts of the interior. One of the few regions in which archaeological inroads can be made successfully into the inland zone is the Kobuk River region of northwestern Alaska.

During the Point Hope Expedition of 1939,[3] of which the writer was a member, the Kobuk-Noatak drainage system was a recurrent topic of anthropological speculation. Helge Larsen maintained that if some parallel to the Caribou Eskimo culture was to be found in the west the logical place to begin a search was along the Kobuk River, which is one of the few western inland localities boasting a permanent Eskimo population. Dr. Rainey, whose earlier work in central Alaska[4] had brought forth evidence of early man as well as of late prehistoric Athapascan sites, agreed upon the importance of the inland focus and made plans for future work there. The discovery of the ancient Ipiutak site at Point Hope, however, diverted attention from the inland region and interrupted plans for extension of the investigations there.

The following summer, when the writer planned a tree-ring collection trip from the Koyukuk River across to the Kobuk headwaters and down

[1] Rainey, 1941*a*.
[2] *Ibid.*, p. 459. Italics added.
[3] Rainey, 1941*b*.
[4] Rainey, 1939.

to Kotzebue Sound, Rainey again stressed the need of archaeological reconnaissance in the region. During that season, 1940, a number of old village sites were found in forested areas from the head of the Kobuk to Kotzebue Sound and on Seward Peninsula,[5] and collections from test excavations revealed two significant facts. First, the Kobuk sites, though undoubtedly Eskimo, possess an environmental and cultural character at variance with coastal sites, as well as with Athapascan sites. Second, the sites could be dated by the tree-ring method.

In 1941 the University of Alaska sponsored a full season of investigation. With the assistance of John Newcomb, of the University, and capable Eskimo labor, supplied in part by the Civilian Conservation Corps, we progressed from Shungnak ("jade") on the upper Kobuk to Kotzebue Sound, excavating house ruins in seven principal old village sites and making test excavations in eight others. Results of the two seasons include the excavation of sixty-six house sites, a large collection of artifacts adequate for typological and chronological studies, and tree-ring dates for five major sites.

The similarity in all of the investigated sites appears to be the result of environmental rather than cultural unity. Extensive use of antler, special river-fishing equipment, and a central fireplace in most of the houses reflect adaptation to an inland, forested locale. House pits were invariably dug into coarse sand rather than into silty soil or gravel along the river, in contrast to the situation at Kotzebue where, as elsewhere on the coast, the pits were in gravel. Aside from these points of similarity, the sites are clearly distinguished from one another by differences based on time or environment, or both.

The sites may be classified environmentally into upper river, middle river, and coastal types, regardless of chronology, and may be characterized, respectively, as nomadic hunting sites, permanent fishing sites, and coast sealing sites. For lack of space the three zones are treated in the following paragraphs by a description in some detail of a single site for each zone, together with a few notes on important related sites. The accompanying map, Figure 5, shows the location of major sites.

Dating and chronological significance are discussed separately.

THE UPPER RIVER ZONE

A number of ruins were discovered in the area extending from Hunt River, a Kobuk tributary roughly 150 miles (by river) from the sea, to Pah River, in the Kobuk headwaters. Some appear to have been large, though impermanent, villages. The river margins in this area, rather heavily forested with spruce and birch, are frequented by moose, bear

[5] Giddings, 1942*b*.

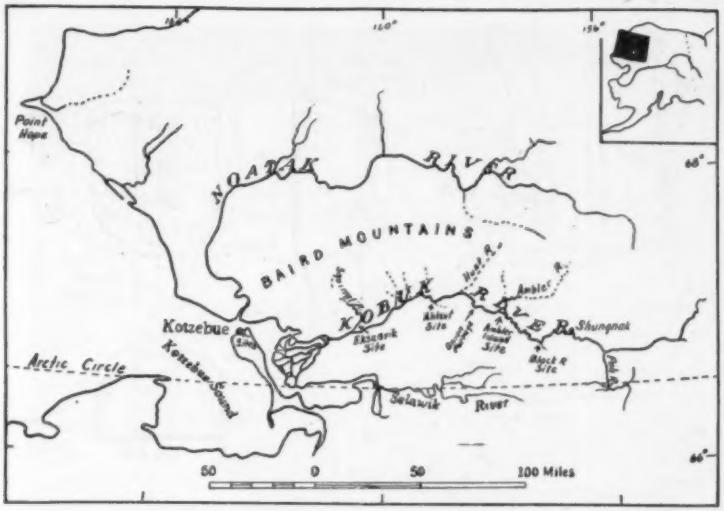


FIG. 5.—Map of Kobuk River region showing important sites (insert shows area covered).

and other forest-dwelling game. Several short portages lead over the rugged mountain range to the north into the caribou grounds of the upper Noatak, and there are reports that large bands of caribou formerly ranged over the whole area. Fish abound in both the streams and the lakes, but salmon, by the time they reach the upper river, have become less numerous and less nutritious than they are nearer the sea. The climate is warmer in summer and colder in winter, but less windy at all seasons, than that of the coast.

Ambler Island Site. The Ambler River, one of the largest tributaries of the Kobuk, enters the main stream about seventy-five miles below Shungnak Village. At the mouth of the Ambler the Kobuk divides into two almost equal branches, forming an island which is roughly a mile in diameter and is densely forested with spruce and rimmed by willow thickets. An old village of fifteen house ruins, lying along a sand ridge near the center of the island and pointed out by a Shungnak Eskimo, was completely excavated.

The house pits were lined and rimmed with tall grass, greener than the surrounding turf. The edges of the pits were rather sharply defined by prominent rims, under which excavation proved the wall outlines lay. Contiguous to each house pit was a small, rectangular cache pit.

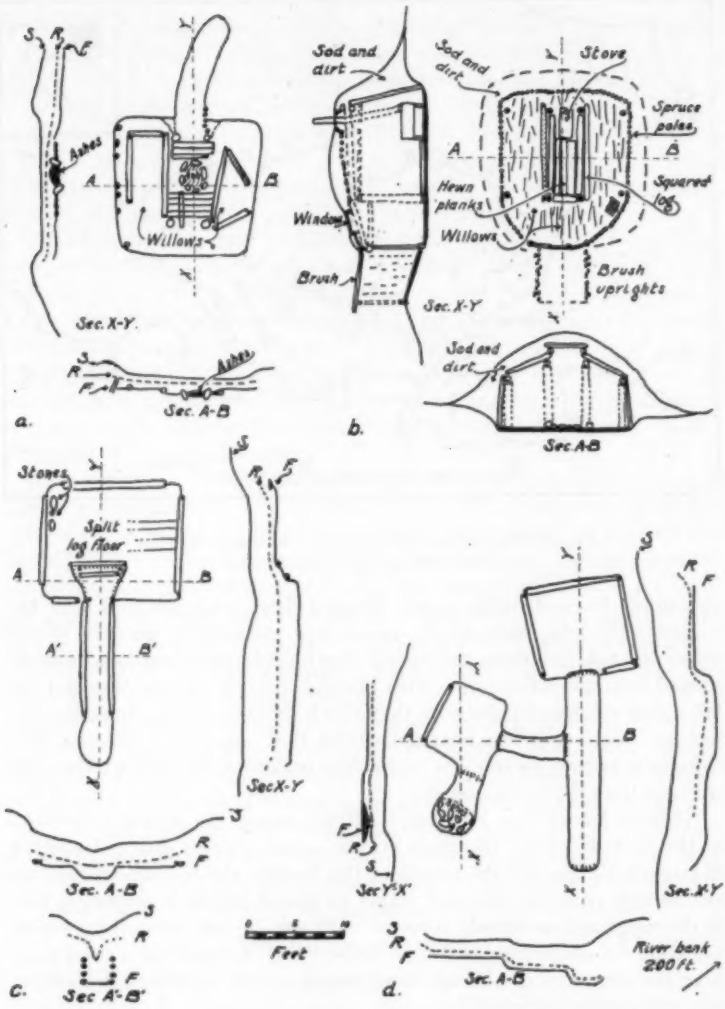
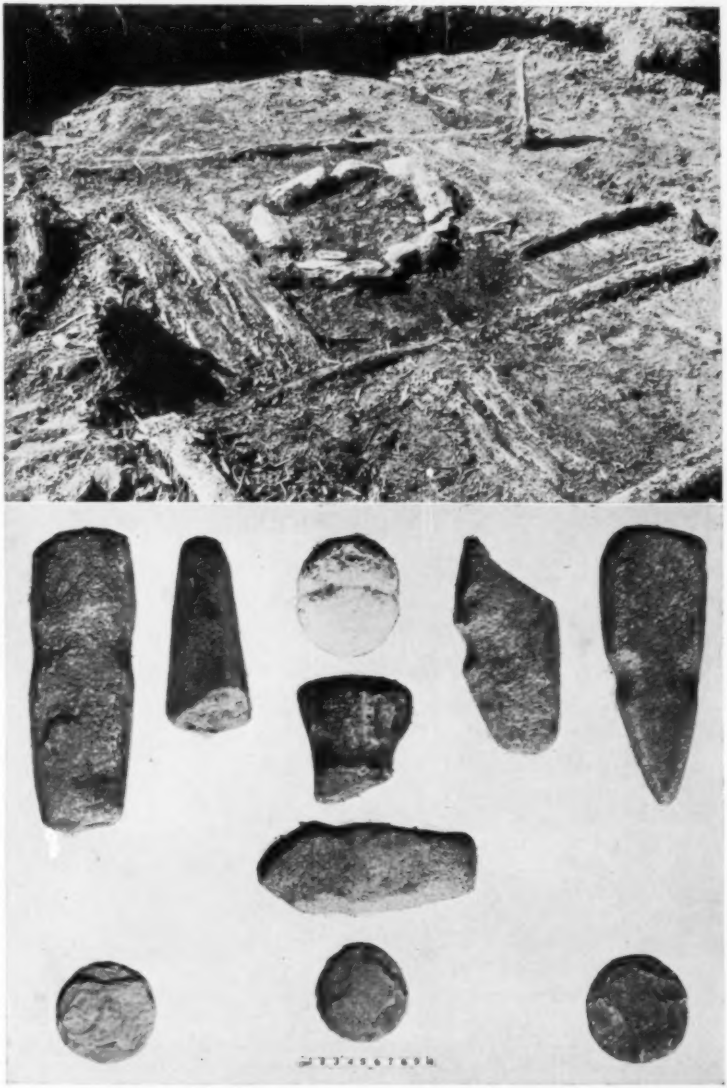
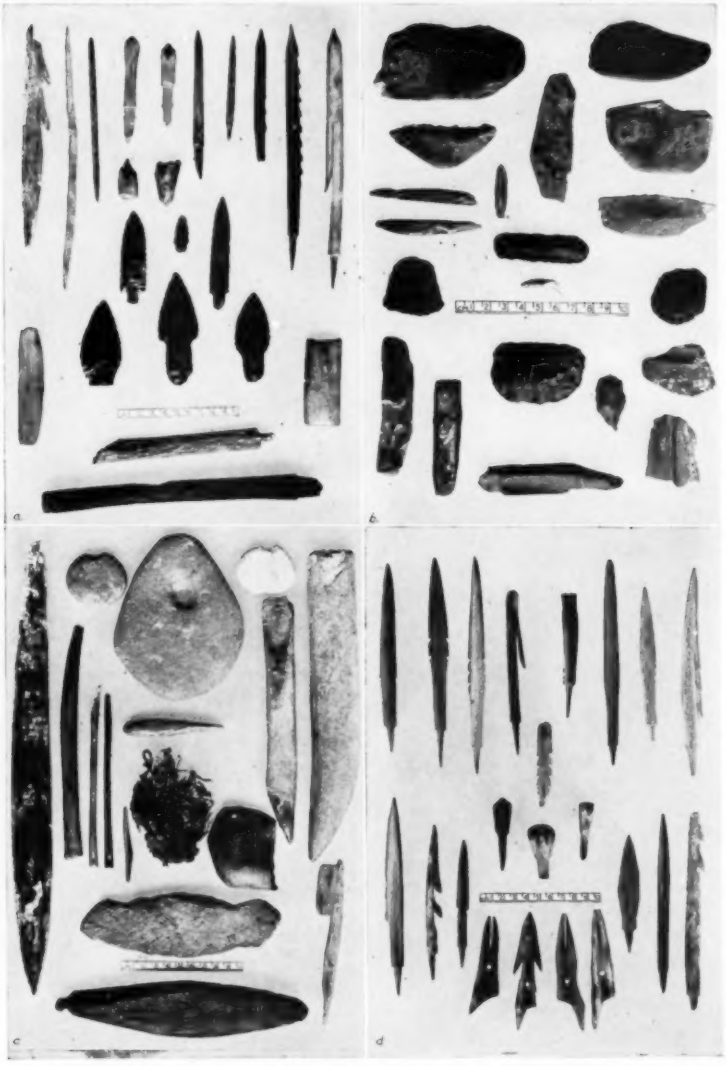


FIG. 6.—Plans and cross-section of houses. *a*, House 2, Ambler Island; *b*, modern winter house, Ambler River; *c*, House 12S, Ahteut; *d*, House 3N, Ahteut. In cross-sections, S = surface of ground before excavation, R = fallen roof, F = floor.



House site and artifacts, Kobuk River sites. *Upper*, Ambler Island, House 2, floor detail; *lower*, objects of pecked-stone and *tci-tho* scrapers of slate from Ahteut.



Artifacts from sites on Kobuk River. Ambler Island: *a*, hunting equipment: arrowheads, leister prongs, sealing dart, bow brace, wrist guard, toy bow (?), dart socket piece, flint and obsidian points; *b*, worked jade: *ulo* blades, man's knife blades, chisel-like blades, blunt awl-like implements, sawed fragment; flint scrapers and hand drill; tooth pendant; *c*, fishing equipment: ice picks, line guide, hooks, sinkers, fragment of willow-bark net, net floats, sinkers, netting gauge. Ekseavik: *d*, arrow points and harpoon heads, mostly of antler.

The inner date of a core taken from one of two spruce trees which grew out of two house pits is 1894; the core from the other has an inner date of 1846. These living trees provided evidence that the houses had collapsed and the resulting depressions had reached their present condition as long ago as fifty and one hundred years, respectively.

All fifteen houses conformed in general to a single construction plan. The type house (Fig. 6*a*, and Pl. X, *upper*) had a rectangular floor, a short entrance tunnel opening southward from the center of one long wall, and a central, usually stone-rimmed, fireplace. Two pairs of stout posts had supported the greater weight of the roof. The posts of each pair were separated by the width of the tunnel at its inner end; the first pair was set in the ground a few inches to a foot or two within the house in front of the tunnel, the second pair was set in a corresponding distance from the rear wall. The ventilator was probably in a flat section of roof between two ridge poles supported by the pairs of posts. At each of the four corners of the house stood a smaller supporting post upon which rested roof cross-beams. The vertical poles forming the end walls of the house were short (four or five feet), to allow for pitch in the roof. In some of the houses base logs extended between the inner posts on each side of the fireplace to protect the edge of a shallow bench which had not been excavated to the level of the floor in the center. The fireplace, located between the four inner roof supports, usually toward the front of the house, was rectangular or oval in shape and was outlined by a rim of large stones. Split logs or planks were sometimes used as a surfacing for the central floor at each end of the fireplace. Young willows had been spread on the benches.

The length of the relatively short tunnel, on the average, was about equal to the width of the house. The tunnel floor at the house entrance was on a level with the house floor, and either continued at this level to the edge of the slope or rose slightly to ground level.

The details of an Ambler Island house at the time of occupation are perhaps approximated closely in the semi-subterranean houses occasionally occupied at the present time by natives of the upper Kobuk. A house of this type, inhabited each winter by a Shungnak family, is illustrated in Fig. 6*b*. It stands on the right bank of the Kobuk at the mouth of the Ambler, just opposite the island. The position of the center pairs of posts and their function are analogous to those found in the abandoned house site. An iron stove and flue have replaced the fireplace and smoke hole, the tunnel has become almost vestigial, and the floor is not far below ground surface; but in details of support, roofing, and general plan, the relationship between this house and prehistoric house types is clear. Upright poles form the walls; cross-beams are laid into

notches made in the tops of supporting posts; the top of the roof is flat; and the whole structure, with the exception of the entry-way, is covered with sod blocks and sealed with dirt. The glass window set in the roof may be analogous to an earlier skylight of gut, which in turn may have been the smoke-hole cover.

All of the Ambler Island houses opened to the south, possibly in some consideration of prevailing winds, ventilation, or system of lighting. This consistent orientation of houses was not observed in other large sites anywhere in the region.

The Ambler Island ruins may represent a village occupied simultaneously for a short time by a large number of families. If so, the population must have been in the neighborhood of seventy-five persons, or nearly as large as the present village of Shungnak. Tree-ring dates, on the other hand, indicate the probability of successive occupation during an interval of several decades (see section on chronology, below). This might mean that the same family, or families, returned periodically to build on the traditional site. The last occupation, however, must have been before the time of wide diffusion of European trade goods, none of which were found in the site. Iron had been used in the composite knives, but this can hardly be considered a dating criterion, since it is apparent that iron was used for blades long before Russian contact.[6] Trees growing out of two house pits were more than 47 and 95 years old, respectively, but, since the presence of these trees on the relatively bare site was in itself accidental, the trees cannot be regarded as furnishing dates for the last occupation of the houses in question. They can hardly have begun to grow until after the houses had fallen in decay; hence their early dates represent only time stops before which the site must have been occupied, just as the bark dates of building logs are time stops beyond which the occupation must have extended.

Characteristic of the site as a whole is the uniformity of culture—the lack of originality in house planning, decoration, and form of artifacts.

Characteristic traits are as follows: (1) extensive use of the local jade,[7] and absence of polished slate; (2) crude *ulo* of jade; (3) various crude jade blades; (4) drill bits of jade; (5) short, socketed-type adz blades of jade; (6) thick adz or ax heads of jade; (7) thin stone "saws," used extensively for cutting jade; (8) large, shallow grindstones with a low hump at center of the basin, probably used in working jade; (9) extensive use of red paint (hematite), as shown by many flat stones upon which paint was ground; (10) stone picks, mattocks, and shovels; (11)

[6] Collins, 1937, p. 304.

[7] A translucent, green nephrite or jadeite found only in the mountains adjacent to Ambler River.

thin stone discs like the Athapascan skin scraper (*tci-tho*);[8] (12) rectangular stone lamps with pecked-out basin; (13) extensive use of antler, and general absence of ivory; (14) arrowheads of antler with multiple small barbs; (15) blunt arrowheads with lobes or facets at the end; (16) socketed adz heads and adz handles of antler; (17) wedges and punches of antler; (18) scoops and rakes of antler; (19) gull hooks (or lingcod hooks?) of antler; (20) sled runners of antler; (21) fish spear barbs; (22) fish hooks consisting of a long, slender shank and separate barb; (23) fishing ice-picks of antler; (24) willow-bark fish nets; (25) rectangular stone net-sinkers with two sets of opposite notches; (26) diamond-shaped net floats of wood; (27) small, notched stone sinkers (?); (28) large, perforated stone sinkers; (29) "chewing" clay, identified by natives who still know its use; (30) extensive use of birch-bark baskets; (31) clay cooking-pot with flat bottom, suspension holes, and often a fluted decoration; (32) projectile points and scrapers of obsidian, in addition to those of flint; (33) two-hand scraper of caribou leg-bone; and (34) houses of the Ambler Island type.

Other traits, found also in most sites of the coastal Eskimos, appear to be rare on the upper river, or of so widespread a distribution as to render them negligible in a site classification. Some of these are as follows: arrowheads with shouldered tang and cylindrical base; sealing-dart heads and socket pieces (one of each); bow braces and wrist guards; projectile points of flint; bone awls; snowshoe needles; labrets; perforated teeth; flaker handles and points; bow-drill parts; swivel parts; cylindrical needlecases of bone; dog-whip ferrules; composite, end-socketed and side-socketed knife handles; drum parts; net gauges; boat hooks; combs; hammerstones; side and end scrapers, and hand drills of flint; whetstones of several types; pyrite cubes; and wooden ladles.

Included in the first group are several traits which may be attributed to the Athapascans, namely: obsidian points with lateral notches in the tang, stone saws, *tci-tho's*, and birch-bark baskets. Traits possibly derived from the same source are grindstones of the Ambler Island type; extensive use of red paint; stone picks, mattocks, and shovels; small notched sinkers; large perforated sinkers; pottery decoration; two-hand scrapers; and arrowheads with multiple, small barbs.

Traits showing connection with the sea coast are the sealing dart of ivory and the dart socket-piece of walrus bone, sled runners of whale bone, and labrets of ivory.

A gauge to the amount and relative importance of stone flaking lies in the number of chips saved. While it is obviously impossible to pick up all minute chips in the course of excavation, it is likely that a certain

[8] See Rainey, 1939, p. 360.

consistency was maintained in the proportion of chips collected to those present in each site, so that we may assume a constant relationship between individual houses and whole sites.

Chips were relatively rare in Ambler Island houses, probably indicating a limited period of occupation for each house. Figures for the whole site are as follows: jade chips, 96; flint chips, 54; obsidian chips, 33. It appears that jade was more important than flinty material, and that obsidian was highly prized. These proportions are comparable with those of other sites of the upriver culture pattern, but differ completely from those of sites on the middle river.

Wooden artifacts, of which the site must have contained a large number, have been preserved only in rare cases. The extensive use of antler, which was clearly the most valuable of the harder organic materials, gives the site a distinctive inland character. The general absence of goods foreign to the region eliminates the possibility of a casual occupation of the site by some stranger group.

Ambler Island may then be considered the home ground of a strongly entrenched inland group of Eskimos, whose dependence on caribou and fish led them to forage widely in small groups during most of the year, but whose gregarious nature brought them together in a semi-permanent village during periods of least activity.

Notes on Other Upper River Sites. Black River site, fifty miles above Ambler Island, differs in only one important respect from the latter site. A heavy base log, about a foot above floor level, lay at each end of a house, suggesting a roof sloping from the central rafters to these end logs, rather than the usual vertical end wall. Tree-ring dates are lacking, but the site appears to be roughly contemporary with the type site.

Tekeahruguruk, Pick River, and Shungnak sites represent a late phase of the upriver culture pattern and, though lacking in suitable tree-ring material because of decay and the persistent use of soft woods, are thought to have immediately preceded the widespread change to surface-built log cabins at the turn of the century. Each contained glass beads, but no other signs of European contact. The few artifacts obtained from limited excavation fit the Ambler Island pattern.

The oldest site investigated in the upper river zone consisted of about thirty house pits at Onion Portage. The presence of rounded clay lamps, textile-impressed pottery, and early flint techniques in four excavated houses with long tunnels indicates contemporaneity with Ahteut, in the middle river zone. A well-developed jade industry, however, shows close affinity with other upper river sites.

Of special significance at Onion Portage was the recovery of three prepared flint cores and a microlithic flake struck from a similar core, all

identical in form with those from the University of Alaska Campus site, which were in turn identified by N. C. Nelson with types from the Gobi Desert.[9] This ancient technique, found in conjunction with the practice of jade sawing in this particular region, suggests the persistence of a tradition antedating development of the Eskimo coastal culture rather than a borrowing of Northwest Coast Indian practices.

THE MIDDLE RIVER ZONE

The more permanent sites of the Kobuk appear to have been localized between the mouth of Hunt River and the Kobuk Delta. The delta itself, bare of timber and lacking attractive sources of livelihood, apparently contains no important old sites. The middle river zone, with its diminishing forests, is beyond the range of moose, but caribou once were plentiful and salmon reach here in great numbers and in good condition. Since the middle river lacks the game resources of the Kobuk headwaters, it is logical that the economy of a group living there should be based partly upon sea hunting. Excavations prove that, unlike the self-supporting groups of the upper river, those living in its lower reaches had strong bonds of cultural kinship with people of the coast.

Ahteut Site. The oldest Kobuk site, called Ahteut after an Eskimo name for the local river bend, lies inland about one hundred miles. Although other sites in the area are known to people of Kiana and Shungnak, we could find no one who was acquainted with this site, either directly or through tradition.

The investigation of a grove of large birch trees, unusual on the lower river, led to the discovery of Ahteut in 1940. The ground surface beneath the trees proved to be pitted with old house ruins. The site begins on the left bank at Kavet Creek, breaks off at the base of a steep sand cliff, and continues for a mile or two on the other side. Although sixty-odd house pits were observed, there are probably twice as many in the vicinity.

Excavations were made about two miles below Kavet Creek on the left bank of the Kobuk. The surface appearance of the ruins indicated essential differences in construction, form, and age from the upriver sites. Some pits were as deep as four feet, even though none of the usual elevation remained about the rims. The rectangular shape of a house was often obscured and appeared, from the surface, to be round or oval. The site was partly covered with dense willows, but mainly with open groves of birch interspersed with a few spruce trees, two or three of which had diameters in excess of two feet.

The twelve house pits which were excavated differed most from

[9] Rainey, 1939, p. 387.

those of the upriver sites in their lack of a fixed pattern of construction. No two of the Ahteut houses had been built exactly alike, and some departed from known types of Eskimo houses.

On the other hand, certain generalities apply to all the excavated houses. The floors, especially of the tunnels, were much deeper than those at Ambler Island and Black River. The tunnels lay from four to six feet below ground surface; the house floors were one or two feet higher. The volume of dirt which had to be removed was at least twice that necessary in upriver sites. The floor of a tunnel was level and did not open directly on the ground surface, so a ladder must have been used for entry into the tunnel mouth from an opening above, except possibly in the case of houses fronting on the river bank. Access to the house proper was by a step up from the tunnel. This kind of entry, similar to that of the "Point Barrow house,"[10] served as a cold trap. Each house had been walled with upright poles, the tunnel, with poles laid horizontally and held in place by uprights at short intervals. Beyond these points the building traits become highly individual.

Four excavated and several unexcavated houses approach in general form the usual Kobuk type; they were rectangular, with greatest length at right angles to the tunnel, and without appendages. A fireplace lay in the usual front-central position between raised side benches fronted by retaining logs. The tunnel step lay either within the front house wall or flush with the wall.

Two square houses resemble the preceding type in plan, but differ greatly in details of construction. One of these (Fig. 6*c*) lacked a fireplace and had been completely floored with split logs; the tunnel extended inside the front wall one-third the width of the house. In the second house the tunnel also extended well into the house, but a slightly raised, continuous bench bordered three sides of a central fireplace.

Three excavated houses, almost square in plan, retained the fireplace and the usual tunnel with a step down within the front house wall, but an added appendage, similar in plan and length to the entrance tunnel, opened opposite the tunnel from the back of the house. This added passage, the floor of which was at the level of the house floor, may have served as a storage room, taking the place of the outdoor sunken cache.

A highly specialized composite house (Fig. 6*d*) may be a logical development from the preceding type, although its exact counterpart has not been found in Eskimo literature.[11] It consisted of a large, square room without fireplace, a tunnel at a lower level, a short cross-tunnel

[10] Murdoch, 1892, p. 72.

[11] A composite house excavated by Helge Larsen at Jabbertown, near Point Hope, more nearly resembles the Kotzebue house described below.

leading off the main tunnel into a square chamber at a higher level, from which opened a small alcove with a rock-lined fireplace in the rear.

An extremely small house (about six feet square) with a short tunnel was located somewhat apart from the other houses. This seems to have been a miniature house either built by children or, more probably, for confinement of women during puberty or childbirth restriction periods. A trace of the floor level remained, but no accumulation of either ashes or debris was found.

All of the Ahteut houses had been dug down into pure sand. Neither logs nor wooden artifacts in excavated houses were well enough preserved for removal intact. Logs and posts, except those which had been charred, were usually no more than dark impressions in the sand. Fortunately, there had been a great deal of burning, and numbers of charcoal specimens, including a few sections of whole logs, were preserved for their ring records. Preservation of bone, antler, and ivory was little better than that of wood. The few sound artifacts of perishable materials that were recovered lay mainly in deep places where frost was most permanent. The cultural stage of the site must therefore be judged mainly on the basis of stone work, pottery, and architecture.

On the basis of the building complex, then, the house ruins at Ahteut, numbering perhaps more than a hundred, may have constituted a fixed village of proportions similar to those of the larger prehistoric coastal villages. At first glance, however, the existence of a food supply adequate for such a large community would seem doubtful. Although caribou may have been plentiful in former times near Ahteut, they were certainly no more stationary in their habits than those in other regions; nor does fishing appear to have been practiced more persistently at Ahteut than in the upriver sites. In the light of these considerations it is well to examine the requirements of a group of some five hundred individuals, together with what can be deduced relative to the nature of the occupation of the whole site and of individual houses from the numbers and types of artifacts recovered, the purposes of these artifacts, and the persistence of types from house to house within the site.

Some light is cast on this subject by the following outstanding traits connected with the site: (1) the absence of any indication of sleds or dog traction;[12] (2) the permanence of semi-subterranean houses compared with those of the upper river, and the presence of a "cold trap" in house construction; (3) the relative abundance of household tools such as the *tci-tho* and the slate *ulo;* (4) the relative and actual abundance of pottery; (5) the complex of Indian-like traits, including the stone-pecking

[12] Collins found that dog traction was unknown on St. Lawrence Island until about the eighteenth century. Collins 1937, p. 338.

technique; (6) the complex of traits indicating coastal connections, such as objects made of whale rib, baleen, and walrus ivory; and (7) the absence of any signs of warfare.

Without sleds, any movement of whole families would be logically confined to the summer months, and presumably the waterways were the principal travel routes, negotiated during the open season by means of skin boats and bark canoes. These conditions would lead to the permanence of winter houses, if only because of the difficulty of moving household goods during the winter. If a family went out periodically, as on hunting journeys on foot in the spring, this would be done on a camping basis, the winter house remaining the storage place of reserve supplies, household equipment, and boats. If annual trips were made by boat to the coast for trading or for spring sealing just after breakup, the family could hardly have returned to Ahteut much before the salmon began to run in late July. Hence, in the press of the two-month fishing season, little time would have been left for moving and rebuilding, and the family would probably have used its house of the previous season. In even a poor fishing season at the present time, a family can easily dry enough salmon to support it through the year, aided by some winter hunting. The keeping of dogs would necessitate a much larger food supply. If the Ahteut people had no dogs to provide for, it is probable that caribou were hunted mainly to the extent necessary to obtain skins for clothing and bedding. In this case fish would have been the principal food supply, and fixed villages, rather than semi-nomadic small bands, would have prevailed.

It is clear that the Ahteut houses were occupied for longer periods of time than were houses at Ambler Island and other more recent upriver sites, in all of which are found abundant signs of sledding. Excavated deeper into the sand, Ahteut houses were provided in some cases with a built-in cache, or storage room, and a deep entrance tunnel, which acted as a cold trap. The great numbers of potsherds, the parts of many distinct vessels, which were in most of the houses almost certainly result from the accumulated breakage of several seasons. Many sherds had disintegrated to such a degree that they were of no collection value. A total of 402 sherds, representing at least sixty-two separate vessels, were recovered from ten excavated houses. The numbers of *tci-tho*, slate blade fragments, and flint chips left in the floor debris of each house were also greater than in the Ambler Island and other later upriver sites. Presumably the absence of a great deal of organic material is to be attributed to decay.

A count of the chips of flinty material (principally chert and chalcedony) saved from ten excavated houses gives some measure of the

relative importance of flint flaking, and of the length of occupation of each house. The average count per house is: flint, 124; obsidian, 3; and jade, 1. This contrasts with the Ambler Island figures of 4 flint, 2 obsidian, and 7 jade chips per house.

In regard to population density, no evidence was found in the twelve house ruins excavated that would point to any considerable time lapse in the occupation of the site. Had such a lapse occurred, some noticeable changes in workmanship and fashions could be expected, as, for instance, in paddled, concentric-circle designs on pottery; in textile-impressed pottery; in the distribution of slate work; and in the size and appearance of *tci-tho's*. Some traits are confined to certain houses, but in each case of this kind the total number of specimens representing the trait is small, minimizing any significance of the distribution. Thus, pecked-stone tools were found in only three houses, but a total of only ten objects in this category was recovered. Finished jade tools were present in only two houses, but there were only three of these objects, plus a few jade chips from these and other houses. In one noteworthy case the contemporaneity of two houses of different form is indicated by the presence in one of the houses of two fragments of a large side scraper which fit together with a single fragment from a neighboring house to make a complete tool. Ahteut appears to represent a single culture pattern rather than a succession of cultures.

From what groups was this patttern derived? Indian influences are strongly present in certain types of stone work. *Tcî-tho's* are more expertly shaped, more numerous, and more uniform in size than in other sites. Those made of slate are remarkably symmetrical, mainly as a result of careful chipping about the edges. The presence of pecked-stone for splitting-adz heads, pestles, hammers, etc., indicates a relationship to the Northwest Coast, Cook Inlet, and neighboring related areas, while the *tci-tho* seems to be more strictly Athapascan. Other traits which are probably of Indian origin are partly flaked, pick-like and shovel-like objects of slate and other stone, some of which are similar to types from the eastern United States; arrow points of obsidian; large, wide-faced, flint side-scrapers; thin ax-like blades of flaked and ground slate; and special pottery types.

Objects which are probably of Indian origin, or are at least known to occur in like form in the interior of Alaska, are arrowheads of antler with short barbs set off by engraved guide lines; fish-spear prongs with small, offset barbs; salmon harpoon heads; thin, flaked, flint projectile points; microlithic flint flakes; fish scalers of caribou scapula; two-hand scrapers of caribou leg-bone; and extensive use of hematite as paint. Traits which probably fall in this category are large, thin discs of schist

seemingly used as palettes; battered flint nodules; and pecked stone pendants.

Relationship to coastal Eskimo sites is evident in a number of widespread traits which might also be Indian, especially the following: sealing dart heads and sealing harpoon heads of ivory; harpoon blades of slate; harpoon socket pieces; harpoon ice picks of ivory; salmon spear barbs; fish lures; bevel-edged adz blades; mattocks of whale rib; baleen-sided baskets; composite knife handles of ivory; socketed antler adz heads; several types of knife blades of slate; and unidentified objects of ivory and whale bone. Some of these traits imply at least seasonal residence on, or visits to, the coast.

Ahteut pottery appears to be a curious mixture of Indian and Eskimo wares, thus raising the question of the origin of far-northern pottery. The vessels, with round or conical bottoms and of varied form and size, include small, knobbed cups, oval lamps, and deep, wide-mouthed bowls with capacities of three or four gallons. Fluted rim decorations, consistent use of a paddled, concentric-circle or spiral design on the exterior,[13] and textile (probably twined basketry[14]) impressions on the inner surface all add to the complexity of the clay-working industry. Some of these points indicate connection with pottery forms of eastern North America. On the other hand, the coarseness of the ware and the lack of firing are characteristic of Eskimo pottery of the coast, and paddled impressions on the outer surface of vessels are present on the earliest known Eskimo ware.[15] Everything considered, however, the Ahteut pottery is probably more Indian than Eskimo in its affinities. In diversity of form and in relative importance in a site, this ware is unique in Arctic America.

Compared with the upper river culture pattern, the most notable absence in the Ahteut complex is that of the jade-working industry, including various implements of jade, the stone saw, and probably the large, shallow grindstone with a center hump. Replacing this industry is the marked development of knife blades of polished slate. Certain traits are important at Ahteut, but not in upriver sites, namely: (1) objects connected with sealing; (2) large, broad-faced flint scrapers; (3) barbs for salmon spear prongs; (4) the use of coastal materials such as

[13] Frederica de Laguna, 1939, p. 340, considers this form of pottery design as belonging primarily to the Birnirk period of Eskimo culture.

[14] Dr. Emil W. Haury, of the University of Arizona, who has examined sherds from a single vessel of this ware, observes that the impressions might be those of a form of twined basketry, but he suggests that a more detailed study should be made on all available sherds.

Evidence of basketry, though indirect, is noteworthy in connection with an Eskimo site at the Arctic Circle in such early times.

[15] Collins, 1937, p. 168 and Pl. 52; Rainey, 1941*a*, p. 550.

walrus ivory, baleen, and whale bone; (5) the stone-pecking technique and associated special types; and (6) specialized pottery techniques, as shown in vessel forms, relative abundance of sherds, and textile and paddle impressions. Ahteut is further distinguished from the later upriver sites by the abundance and perfection of *tci-tho's*, by greater emphasis on flint work, by the specialization and originality of its house builders, and by the absence of any signs of sledding or dog traction.

Ahteut is clearly related in other respects to sites of the upper Kobuk, differences appearing mainly in styles of workmanship rather than in occurrence of traits.

Ahteut appears to have been inhabited by a large group of Eskimo people with strong Indian cultural affinities who preceded the Ambler Island people and were established for some time in a fixed locality. The relatively sedentary hunting gave them more leisure time in which to develop artistically and individually. They were by no means isolated, however, but maintained friendly relations with coastal and inland groups at considerable distances, and acted as intermediaries in the exchange of both articles and ideas between Indians and coastal Eskimos.

Notes on Ekseavik Site. One of the most important sites in the Kobuk region is Ekseavik, on the Squirrel River, a tributary of the Kobuk. Discovered by the writer in 1940 and excavated mainly under Mr. Newcomb's direction in 1941, Ekseavik is remarkable for the exceptional preservation of perishable artifacts, as well as of datable wood. Cross-dated by tree-rings with Ahteut and Kotzebue sites, this old village of some thirty houses shows striking parallels with distant coastal sites, as well as a continuance of the Ahteut cultural traditions.

While objects with Indian affinities are notably lacking, Eskimo traits include harpoon heads of two Thule types (two heads of different types are practically identical with those illustrated by Mathiassen from a grave find near Kuk on Southampton Island[16]), broad-bladed arrowheads of antler described elsewhere only from Baillie Islands;[17] a winged needle case, a wound pin, float plugs, and harpoon ice picks of ivory of early north Alaskan coastal types; and many other objects found in coastal collections. A distinctive form of arrowhead, end-notched on one surface for receipt of a special form of thin, long flint point, suggests lance heads of similar form from Aleutian sites.[18] A single thin, ivory "engraving tool" is of the same form as similar, though more elaborately decorated, specimens from the earliest Point Hope and St. Lawrence Island cultures.[19] The nine houses excavated conform to a single pattern:

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[16] Mathiassen, 1927, p. 259, Pl. 73, *11* and *12*.

[17] Wissler, 1916, p. 430, Fig. 36*o*. [18] Jochelson, 1925, Pl. 23.

[19] Rainey, 1941*b*, Pl. 8, No. 8; also 1941*a*, Fig. 35, No. 10.

they are rectangular and have long, deep tunnels, fireplaces, raised benches, and occasionally a small storage niche in the rear wall.

THE COASTAL ZONE

Kotzebue. Kotzebue Village, permanently inhabited at the present time by about 350 Eskimos and twenty or thirty whites, lies at the end of the long, narrow peninsula separating Hotham Inlet and Selawik Lake from Kotzebue Sound. All of the water from the three rivers draining the south slopes of the Brooks Range—the Kobuk, the Noatak and the Selawik—passes through the four-mile opening between Kotzebue and the mainland to the north. This shallow waterway, although impenetrable to large ships, can be negotiated by flat-bottomed river boats and small ocean-going launches.

Kotzebue has become a permanent village since the establishment there of trading posts, missions, and government offices at the turn of the century. Before that time it served principally as a congregating place for native traders from various coastal points and the interior rivers, with emphasis perhaps on sealing as a means of livelihood. The water which flows in front of the village varies from brackish to fresh enough to drink, a factor which influences the economy of the people residing there and is in contrast to the situation at such whaling and sealing stations as Point Hope and Cape Prince of Wales. As a gathering place for various groups of people who tend toward nomadism, however, Kotzebue offers many food-gathering opportunities. After the breakup in the spring, beluga, which are small white whales, appear in great numbers at the mouth of the inlet of Shesualek, whence they are skillfully herded by natives in boats and kayaks into the shallow water of the Noatak River sand flats and are slaughtered in great numbers. The beluga continue to appear on into the summer, when there is also sporadic sealing. In July and August, the salmon begin to enter the river mouths, and fishing by means of nets provides an industrious family with an abundance of winter food for both men and dogs. After the freeze-up, sealing in open water far offshore and trapping and hunting inland are further means of gaining a livelihood. During the winter, tomcod are caught by jigging through holes in the ice near shore, and large sheefish are hooked in deep, fresh water off Pipe Spit.

Early travellers in the Kotzebue region, from Captain Beechey, in 1826, to traders and prospectors in gold-rush days, have remarked the existence of a large summer tent village at the present site of Kotzebue, populated at the peak of its occupation by about a thousand Eskimos, who gathered there from all the river and coastal points in the region.[20]

[20] "This was a temporary camp which is located here for a few weeks each summer

No mention is made of a winter village prior to the arrival of the white traders and missionaries.

Although Kotzebue was visited during the past two decades by many of the archaeologists interested in northern Alaska, no systematic excavations were made there. The small collections purchased from time to time from natives were considered to be recent or part of the accumulation left by summer campers. This neglect of Kotzebue as an archaeological site of importance is due largely to the absence of midden deposits above the surface of the ground.

The discovery at Point Hope in 1939 of an extensive old village site, on comparatively level terrain almost entirely lacking surface indications, inspired a search for sites of a similar nature in other localities. It became apparent that places where the Eskimos built permanent houses on the same limited area year after year, thus producing extensive concentrated accumulations of midden debris, were exceptions rather than the rule. This observation was borne out in various localities during the following two years of field work.[21] The older house ruins in most areas were likely to be inconspicuous or entirely hidden from view.

At Kotzebue, in the fall of 1941, collections of artifacts were offered for sale by the villagers, who said that these objects had been unearthed during the preparation of house foundations, gardens, etc., and that traces of house floors had been observed. In response to further inquiry, natives remembered shallow pits along an old beach line about two miles west of the village. In this way, an extensive old site was discovered reaching from the present village to the cold storage tunnel about two miles westward, and spanning at least three old beach lines.

The most recent of the ruins are well-defined pits on the tundra at the farthest point from the village. A test excavation in one of these brought forth trade goods, in the form of glass beads and iron, and building timbers carrying dates later than 1850. None of these ruins was completely excavated when it was discovered that many shallow pits discernible from the ground surface extend all along the willow-covered tundra rimming the beach. The older pits are invariably covered with the dense willow thickets one to three feet high which characterize that edge of the tundra. Although no attempt was made to count these pits, they are estimated at well over a hundred.

Two ruins excavated about a mile and a half west of the village lack trade goods, but show evidence of dog traction. The group to which these houses belong and the boundaries of which were not determined is designated the Intermediate Kotzebue site.

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for the purpose of trading with vessels which cruise in these waters, as well as for meeting and trading with the people from both shores of Bering Strait." Nelson, 1899, p. 262.

[21] Rainey, 1941*a*. p. 565.

Extending westward from the outskirts of the present village for about a mile and well back into the tundra were many house pits which are shallow and inconspicuous from the surface. These were not recognized as house pits until we had walked over them many times, but, once identified from the low relief of former rims and the relative amounts of berry bushes and low willows within their bounds, numbers of them could be located from the surface.

Because of the lateness of the season, only two houses of this Old Kotzebue site were excavated. One of these, however, had been a composite house, consisting of a very large room with fireplace and a side room; the deep tunnel of each room opened into a common entrance chamber. A storage room in the form of a long tunnel also opened off one side of the entry. The other ruin was more conventional in form, resembling the Ekseavik house type, but was clearly related in culture to the composite house. Surface obscurity precluded an accurate estimate of the number of pits to be identified with this early culture phase, but there is reason to believe that many houses were occupied in the area for long periods and that test pits may uncover even earlier ruins.

The old site shows clearest cultural unity with Ekseavik, with which it was contemporary, but certain traits recall Ahteut, namely: pottery imprinted with spirals and concentric circles (a single paddle made of whale rib has a raised series of spirals on its inner, flat, slightly recurved face, and a series of finger grooves in the handle); a pecked-stone adz head; and a special form of barb on a salmon spear. There is no clear relationship with Ambler Island or other upriver sites. A preponderance of objects connected with sea hunting distinguishes this from sites of the middle river, but both Kotzebue sites show evidence of a strong reliance upon fishing and caribou hunting as well as on sea hunting.

CHRONOLOGY

Tree-ring dating provides not only a linkage of the Kobuk sites but a sound basis for their evaluation. The Kotzebue sites and those of the middle river are relatively dated in a "floating chronology" five hundred years long, and the Ambler Island site is actually dated by means of living tree groups in the region. Further work in the Kotzebue sites, interrupted in 1942 but planned as an important future project, will perhaps join the relative dating to the equally long actual chronology. A probable fifty-year overlap between the two chronologies offers a tempting opportunity for speculation, but, in view of the ease with which the question can be settled when material is available, the dating will rest for the time being on the amply verified separate chronologies.

Several recent sites, the archaeology of which could scarcely justify

the time required for excavation, were dug into for log samples from which to determine their age. Obviously recent house pits at Kotzebue, on the middle Kobuk, and at Ambler River carry bark dates ranging from 1830 to 1890. At about the latter date, iron axes had become generally available, and the partly underground house was being given up in favor of the log cabin.

Twenty-six dated log samples, each having between 100 and 250 annual rings and retaining either the bark ring or outer rings clearly near the bark, indicate that the period of the most building at Ambler Island was the decade before 1730 A.D., but that at least two houses were either built or remodelled after 1750.

In the relative chronology, five charcoal dates from the composite house at Ahteut indicate its construction shortly after R.D. (Relative Dating) 230, or some three hundred years before the occupation of the Intermediate Kotzebue site. Ekseavik and Old Kotzebue are roughly contemporary, with ample bark dates around R.D. 400, and the construction of the Intermediate Kotzebue houses extends past R.D. 530.

The individual house site cannot be distinguished in most cases from the village in point of time because of insufficient material. At Ekseavik, however, Houses 1, 2, 3, 7, and 9 were probably built in the decade preceding R.D. 400, while House 8 was built some thirty years later.[22]

The relative ages of the older sites would be extremely difficult to ascertain in the absence of tree-ring dates. Traits as definitive as paddle-impressed pottery in three sites and its absence in another would indicate an age difference, but site preservation does not lend consistent support to such dating criteria. And differences in workmanship, types, frequency of distribution, etc., must inevitably be misleading.

Let us consider some of the applications of only the relative dating. Signs of dog traction were found neither at Ahteut nor, 150 years later, at Ekseavik and Old Kotzebue, but in even the limited excavations of Intermediate Kotzebue, sled shoes and other appurtenances of sledding were very much in evidence. Thus, while sledding may have been known to the earlier people, it became important only after the abandonment of both Ekseavik and the excavated houses at Old Kotezbue. Extensive future excavation at Kotzebue will probably furnish dates for the advent of dog-sledding, together with evidence of its effect upon Eskimo economy. Paddled pottery of the Ahteut type is known from the early Birnirk site at Point Barrow,[23] from Jabbertown, and from several burials near the present village of Point Hope;[24] it was made later at

[22] Details of this dating are described in Giddings, 1942*a*.

[23] de Laguna, 1939, pp. 334–343.

[24] A large number of paddle-impressed sherds were found in the so-called Tigara burials, but vessel forms could not be accurately determined.

Ekseavik and Old Kotzebue, though not predominantly; and it had disappeared by the time of Intermediate Kotzebue. The flint-working techniques, also with a wide areal distribution, underwent constant change. Ahteut flaked points are also found in certain early Tigara burials, together with other artifacts of Ahteut type. The more recent mound at Point Hope, however, apparently contains only points of the Ambler Island type. Salmon spear barbs of a special form were found at Ahteut, Old Kotzebue, and Ekseavik, and in the above-mentioned Tigara burials, but not in later sites; hence a type which had persisted for at least 150 years appears to have been forgotten after R.D. 400.

In another application of the dating, one sees that two sites known to be contemporary, Ekseavik and Old Kotezbue, present striking differences in techniques and style of culture, indicating divergence in family or group affiliation.

The actually dated Ambler Island site has few points in common with a dated contemporary site on St. Lawrence Island, though both were presumably Eskimoan. The differences are due primarily to environment, to the widely variant sources of food and raw materials.

A tree-ring chronology, though presenting in this region only a series of time stops before which construction and abandonment must have taken place, nevertheless furnishes the only accurate means of determining times of innovation and relinquishment, the meaning of environmental similarities and differences, and the periods when a fair comparison can be made between distant groups.

PERSPECTIVE

Any attempt to review the field of Eskimo archaeology and to interpret the Kobuk culture patterns in terms of broad relationships would be unwise in this limited report; in fact, such an attempt would perhaps be ill-advised until the dating of the relative tree-ring sequence and the known chronology are bridged with material yet to be collected. However, a few summary facts may be stated.

For several centuries in northwestern Alaska, while the coastal Eskimo culture was undergoing changes in styles of art and workmanship—was perfecting certain techniques and outgrowing others—analogous changes were taking place in an adjacent, forested, inland zone. Coastal influence perhaps dominated such inland complexes as flint-working, sewing, and ornamentation, but the inland people developed a jade-working industry in the vicinity of the only known jade deposits in that section of the continent, making use of an un-Eskimo technique in sawing jade. The earliest inland sites appear to be as strongly rooted in the area as later ones, with no hint of recent immigra-

tion from either the east or the west. Indian-like pottery and skin scrapers are found at Ahteut, side by side with harpoon heads like those of the Punuk Culture of St. Lawrence Island. Half-underground houses with tunnels persisted from early to recent times in an area free of winds, but the oil lamp was subordinated to a large central fireplace in which logs were burned.

That Kobuk dwellers have been Eskimos from very early times is suggested by their preference for coastal practices when they are at all in keeping with the surroundings. On the other hand, their adaptation to the forests and streams shows originality and implies borrowing of Athapascan traits. But the origins of northern Athapascan culture are obscure. The inevitable question is: "How long has Athapascan distribution been the same as it is today?"

The well-known proposal of Birket-Smith that the Eskimo culture originated in the region west of Hudson Bay and spread westward across the Barren Grounds suggests that Eskimos could once have been masters not only of the tundra but also of the northern forest border.

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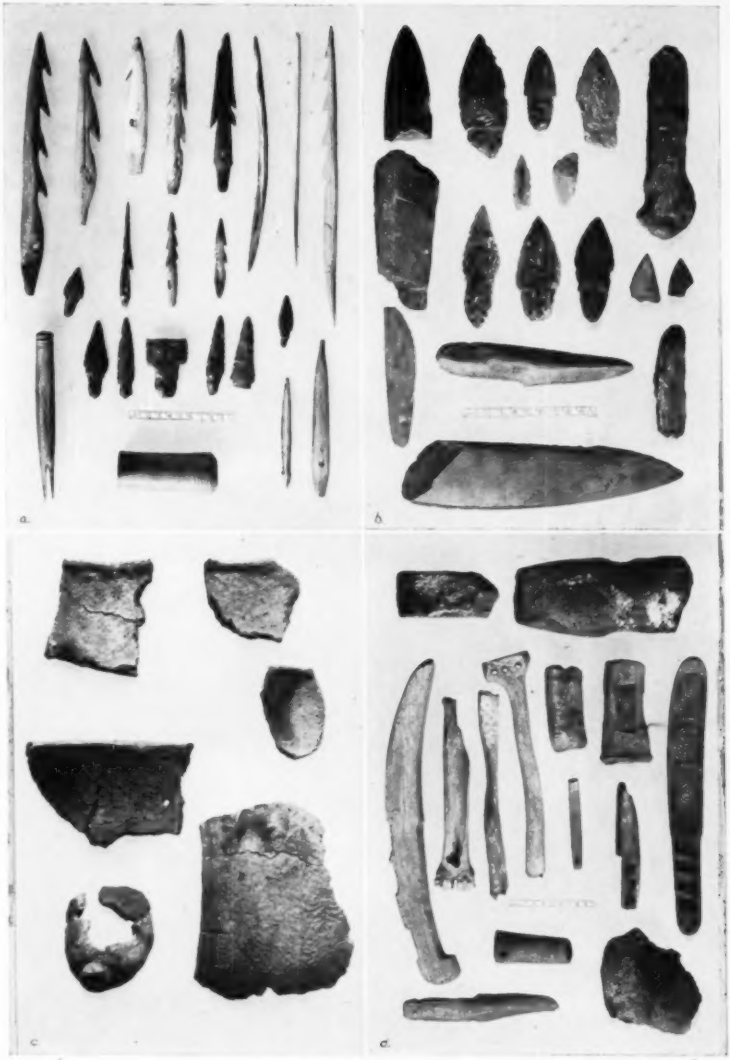

Artifacts from various Alaska sites. Ekseavik: *a*, hunting and fishing equipment: heads of salmon harpoons, heads of sealing darts, leister prongs, flint points, dart and harpoon socket pieces, harpoon foreshaft. Ahteut: *b*, jade knife and small jade blade, two harpoon blades of slate, obsidian point; *c*, textile-impressed sherds, perforated sherd, paddle-marked fragment, small vessel partly reconstructed. Old Kotzebue site: *d*, slate adz head, pecked stone head, antler adz heads and handle, two hand scrapers of deer leg bone and one of antler, whalé rib pick, pottery paddle and impressed sherd, three unidentified objects.

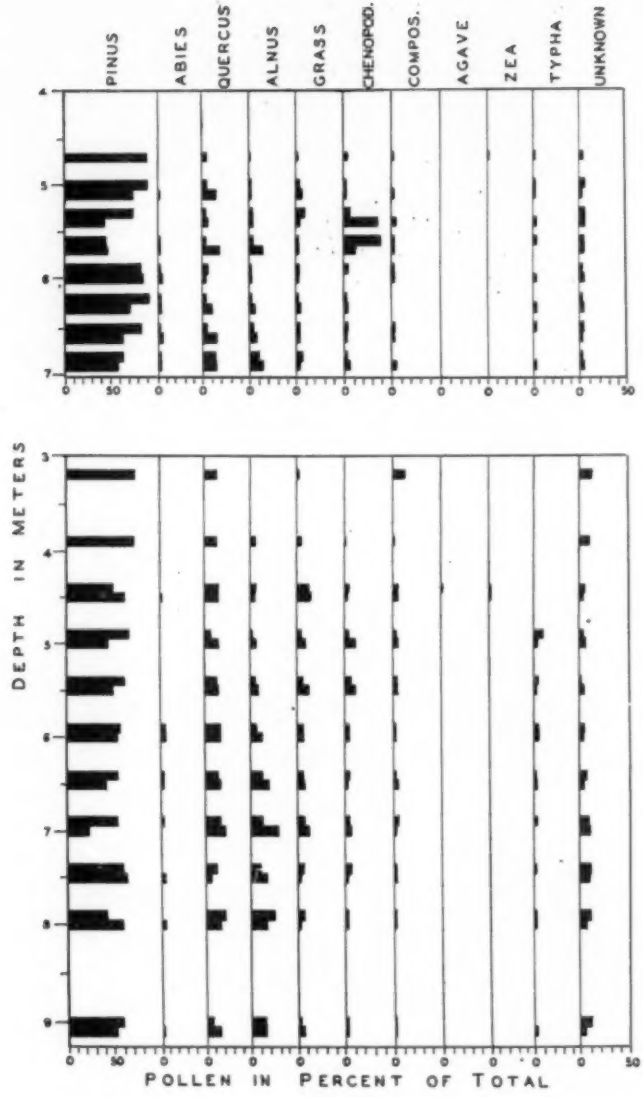

FIG. 7.—Pollen percentages in Pátzcuaro borings. *Upper*, Boring P-1, water depth 4.1 meters; *lower*, Boring P-3, water depth 2.9 meters.

POLLEN ANALYSIS AND MEXICAN ARCHAEOLOGY: AN ATTEMPT TO APPLY THE METHOD*

EDWARD S. DEEVEY, JR.**

THE studies reported here were made during a brief field trip to Mexico in the summer of 1941, when two weeks were spent in Mexico City and one week was spent in Michoacán. In so far as archaeological material was touched, they represent a venture into a field of research in which the author possesses no competence or previous training. The main object of the trip was limnological, and financial resources were meager. How blind the resulting gropings were was fully appreciated only after the trip, when a better acquaintance with the literature on Middle America was possible. Although some definite results were achieved in the form of a respectable pollen sequence 6.2 meters in length, obtained from deposits of the modern Lake Pátzcuaro, the pollen analyses from cultural sites in the Valley of Mexico and at Tzintzuntzan were negative. Nevertheless, it is felt that their publication is justified, since the method, if properly applied, holds distinct promise, and future workers will undoubtedly wish to know what was done and wherein the failure lay.

I am very grateful to Dr. Alfonso Caso, Director of the Instituto Nacional de Arqueología e Historia, for permission to visit the various sites; to Dr. George C. Vaillant, who conducted me over the site of Zacatenco and gave much useful advice; to Ing. Ezequiel Ordoñez, who accompanied me to Cuicuilco; to Mr. Wilfrido Du Solier, my guide at Copilco; and to the entire staff of the Estación Limnológica, Pátzcuaro, Michoacán, especially to Dr. Fernando De Buen, Adviser, and Ing. Manuel Zozaya, Director, for their most generous hospitality and invaluable assistance during my stay at Lake Pátzcuaro.

POLLEN ANALYSIS IN AMERICA

Although it has been known for a long time that the pollen grains of different genera and species of plants can be identified and are often preserved in the deposits of inland waters, the modern stratigraphic technique dates from the work of Lennart Von Post, in 1916. A vast European literature has grown up around the method and its application

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* Contribution from the Department of Biology, The Rice Institute, Houston, Texas.

A translation of this article into Spanish appeared in *Ciencia*, Vol. 4, Nos. 4–5, pp. 97–105, December, 1943.

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to problems of vegetational succession, glacial and post-glacial climatic change, glacial geology, and human prehistory. Bibliographies have been published periodically by Erdtmann,[1] and for prehistory particular reference may be made to the papers of Godwin.[2] In America, however, progress has been slow, and, while we are beginning to have a conception of the series of vegetational changes to be expected in the eastern United States,[3] little information is available for other regions, nor has there been any concerted attempt to apply pollen analysis to problems of archaeology.

There are at least two reasons for the latter failure. In the first place, pollen analysis is not a very precise chronological method, or even as yet an absolute one. It is capable of dividing post-glacial time into five or six segments, but the lengths of these are unknown and probably vary from place to place, while the total length of post-glacial time is also unknown. Therefore it does not appeal strongly to the American archaeologist, who cannot fail to draw invidious comparisons with the tree-ring chronology. In the second place, within the eastern United States, where the position of pollen analysis is strongest, the archaeologist is compelled by general considerations to doubt that any known culture can boast an antiquity measurable in the thousands of years required by the pollen analyst. The recent monograph on the Boylston Street Fish Weir,[4] of course, provides the outstanding exception, in that Benninghoff and Knox have endeavored with moderate success to fit the pollen flora associated with the weir into the sequence established for southern New England.[5] But this work will remain an exception until further progress is made both in the refinement and extension of pollen analysis and in the stratigraphic archaeology of the region.

Elsewhere in the New World, as in the Southwest and in Middle America, the situation is reversed. The archaeologist readily admits a considerable antiquity for the earliest cultures, but no attempt can be made to employ pollen analyses in the dating, since the vegetational history of these regions is almost unknown.[6]

It may be that a tradition has arisen that peat bogs provide the ideal receptacles for pollen-bearing sediments; since peat bogs are virtually confined to the glaciated areas, studies in other regions may have seemed

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[1] Erdtmann, 1927–1940.

[2] Godwin, 1934, 1940. Godwin and Clifford, 1938.

[3] Sears, 1935 *a*, *b*; Cain, 1939; Deevey, 1939.

[4] Johnson *et al.*, 1942.

[5] This problem of the fish weir will be more fully discussed elsewhere, in the light of further studies of pollen sequences from New England.

[6] See, however, Sears, 1932, 1937; Sears and Couch, 1932.

impossible or at least very difficult. Such a tradition, if it exists, is certainly erroneous, for the ideal pollen deposits are laid down in normal lakes. Indeed, in the author's experience, the sediments of peat bogs become proportionately more difficult to analyze for pollen to the degree that they depart from normality in their developmental stages, owing to the "dilution" of a bog's pollen content by the rapidly accumulating peat. Bog deposits have one advantage, however, in being more accessible than lake deposits, since the bog mat takes the place of boat or raft or ice cover as a support for drilling operations. It is true that conditions of deposition are frequently very different in lakes outside the glaciated regions and might conceivably be unfavorable for pollen preservation, e.g., through constant high temperature in the tropics or through periodic desiccation in arid climates; but it is probable that explorations have lagged merely for lack of opportunity rather than because they appear foredoomed to failure.

In the Southwest there is a distinct need for pollen analysis. Although the tree-ring chronology, so brilliantly developed in this area, has given reliable dates for Pueblo and Basketmaker sites, it seems certain that there is a long gap between these sedentary cultures and the much-discussed Folsom complex. It is most unlikely that this gap can be filled by dendrochronology alone, for, while the method can be applied to many sorts of wood, including charcoal from hearths, extension of tree-ring sequences is exceedingly difficult without comparatively long individual series such as those obtained from houses and other constructions. Hence, in attempting to bridge a gap probably measurable in thousands of years, dendrochronology is subject to a law of diminishing returns, imposed in part by the low state of Folsom culture and in part by the perishable nature of the material with which it works. On the other hand, the usual methods of stratigraphic geology are equally unlikely to produce useful results when applied to the macrofossils (extinct mammals) associated with Folsom man, in view of the geologically short time involved and the uncertainty as to the precise time when these animals became extinct. The geomorphic method, as applied by Bryan,[7] gives results that are valid for a particular local sequence of glacial stages, but Bryan's general conclusions are based on long-range correlations between glacial stages in Colorado and in Europe, and at present are merely bold guesses, no matter how probable or how attractive they may seem. Pollen analysis, or a similar micropaleontologic method, appears, therefore, to offer the only immediate hope, for it provides the only chronology that can readily be extended from local

[7] Bryan and Ray, 1940.

to regional sequences and is at the same time securely anchored to the present.

It is worth noticing that, in their common interest in problems of glacial and post-glacial stratigraphy and chronology, our various disciplines represent aspects of one huge field of research, namely historical geography in the wide sense. Thus the aid offered archaeology by ecology is, at least potentially, reciprocal, while geology and biogeography are in turn related to both these fields by the double arrows of reversible reactions. It is not too early to hope that progress will be accelerated by a general realization of the need for cooperation among workers of specialized training.

REQUISITES OF POLLEN ANALYSIS, AS APPLIED PARTICULARLY TO MEXICO

In order to apply the technique of pollen analysis to problems of prehistory in any area, at least four conditions must be fulfilled, of which two must be provided by nature and two by the investigator:

1. There must have been, within the period spanned by human occupation of the area, *vegetational change* for reasons consistent throughout the area. In the great majority of cases this means that *climatic change* must have taken place, although the introduction by human agency of a certain plant may give a valid horizon, as, for instance, does the importation of spruce into Schleswig-Holstein in the sixteenth century. Whether this desideratum is satisfied in Mexico is uncertain. We know of course that the Valley of Mexico held a much deeper lake in glacial times, and that glaciers descended the flanks of Ixtaccihuatl and other surrounding mountains to levels far below the modern snow line.[8] But whether the desiccation took place steadily or with alternating periods of moisture, and whether the climate has changed appreciably since man first entered the Valley, can not yet be proved. There are many indications that the Valley was more heavily forested at the time of the Conquest,[9] and it is usually assumed that subsequent deforestation by the Spaniards, who wished to be reminded of the treeless plains of Castile, is responsible for the present more barren aspect. Be that as it may, it seems likely that deforestation to meet the needs of a heavy population had been proceeding from Teotihuacan times.[10] Huntington has argued forcefully for climatic change, particularly in the Maya area,[11] but his archaeological evidence is largely invalidated by recent find-

[8] Jaeger, 1926. [9] Reiche, 1922.
[10] Vaillant, 1941, p. 65. [11] Huntington, 1913.

ings. There is also a suggestion of climatic change implicit in Vaillant's discussion of changing culture patterns in the Valley;[12] the change from a sedentary agricultural population to the diffused village type with ceremonial center seems to have taken place between Copilco-Zacatenco and Cuicuilco-Ticoman times, and it is possible that this coincided with a slight increase in moisture sufficient to necessitate a "woodland" culture. On the other hand, it seems safer to assume that the pattern was imported from outside the Valley.[13] On the whole, then, Occam's principle of economy of hypothesis compels us to hold in abeyance, for the moment, so detailed an application of the "climatic factor" in human history, but this would not destroy the usefulness of slight changes of vegetation or climate as chronological markers in a pollen sequence. There can be little question that the pollen analyses presented in Figure 7 do in fact show desiccation in fairly recent times, but the question "how recent?" remains for future work to decide.

2. As a second natural condition to be fulfilled, *pollen grains must be properly preserved*. There is little danger that they will not be preserved somewhere in the area, for example in the nearest lake or swamp. The difficulty hinges on their preservation in archaeological material. Specifically, stratified middens like that at Zacatenco, examined in 1941, would seem at first sight to be as favorable places for the accumulation of pollen as are the sediments of swamps; but there is a difference, in that culture material usually is built up above the water table and is thus exposed to leaching and drying, with the resulting oxidation of pollen. Nevertheless, many other organic remains, such as corn husks, seeds, textiles, etc., are found in middens, some of them perhaps protected from oxidation by being enclosed in a pottery vessel, and it is evident that this difficulty, though a real and frequent one, is not inevitable. Pollen does in fact occur in the Zacatenco material, though too sparingly to meet the statistical requirements of the method, and it seems that only assiduity and patience will be required for a more fortunate discovery.

3. Given the foregoing natural circumstances, the investigator must first *establish a standard pollen sequence* in natural deposits, such as those of nearby lakes and swamps. This sequence must obviously be longer than the probable span of human cultures in the area, and pollen spectra associated with particular culture layers may then be fitted to their appropriate horizon. How many borings are necessary for the con-

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[12] Vaillant, 1941, pp. 13–15; 1940, p. 299.

[13] Vaillant and Vaillant, 1934; Vaillant, 1931, 1935*a*, 1938.

struction of the standard, and how far afield they should go, are debatable questions for which there are no exact answers. Although the pollen deposited in a given spot usually comes from a radius of several miles, and in treeless areas sometimes from a radius of hundreds of miles,[14] local vegetational conditions always are reflected to some extent and may be so prominent as to obscure the regional picture. The regional contribution to a pollen spectrum consists primarily of grains normally transported by the wind, while the local contribution may contain grains of insect-pollinated species, which usually produce pollen in small quantity and of relatively great size, weight, or ornamentation. The latter plants are sometimes more interesting than the wind-pollinated species, since they may include important climatic indicators, such as mesquite (*Prosopis*) or agricultural plants such as agave. It is desirable, therefore, to obtain as many borings as possible, in order to "regionalize" even the local components; it should be admitted at once, however, that this has not been done successfully even in Europe.

4. It is almost superfluous to add that the investigator, in order properly to interpret the pollen sequence in terms of vegetational and climatic change, must possess *a knowledge of the regional plant ecology*. Because of the unsubtle nature of the hints given by changes in poller frequency, this is not ordinarily a forbidding matter even for the nonbotanical worker; but there is no doubt that the path is beset with greater perils as we work farther from the thoroughly studied regions of the eastern United States and western Europe. In Middle and South America we shall have to rely more heavily for the present on the reports of travelers and naturalists than on exact ecological research.

METHODS

Field Methods. Samples were secured from the bottom of Lake Pátzcuaro by use of the Hiller peat borer, operated by hand from a small boat anchored securely in shallow water (three to four meters). The depth to which this instrument, as well as the Davis peat borer, will penetrate is strictly limited by the composition and firmness of the sediments. Organic ooze and peat are readily penetrated to depths of ten or fifteen meters, but clay is penetrable to much shorter distances and sand is virtually an impassable barrier. Thus it is obvious that such hand-operated instruments, though they have the advantage of convenience in transportation, are not suitable for work in arid or tropical regions, and a mechanical device such as Wilson's sampler[15] would certainly be preferable.

[14] Erdtmann, 1937*b*; Deevey, 1937. [15] Wilson, 1941.

Samples from archaeological sites were obtained by the simple process of making a fresh exposure and filling shell vials with material taken at intervals in a vertical section.

Laboratory Methods. Pollen methods fall into three classes, all of which were used according to the type of sediment:

1. Simple dispersion with potassium hydroxide is the easiest method, but it is applicable only when pollen grains are sufficiently abundant to be counted directly. At least 200 grains should be present in a microscope slide under a three-quarter inch cover slip.

2. Differential solution is applicable to sandy sediments, the silica being removed by hydrofluoric acid; to peaty sediments, the cellulose being removed by hydrolysis followed by acetolysis, as in the method of Erdtmann;[16] and to marly sediments, the calcium carbonate being removed by hydrochloric acid.

3. Flotation of pollen in heavy liquid (bromoform adjusted to specific gravity 2.3), as in the method of Knox,[17] is applicable to mineral sediments, although the finer grades of clay do not separate well in this technique or in any other yet discovered.

In addition, various combinations of the above methods are practicable and were frequently resorted to.

THE PÁTZCUARO POLLEN SEQUENCE

The first attempt to establish a standard pollen sequence for the highland of Mexico was made in Lake Pátzcuaro,[18] Michoacán. This picturesque and geographically important lake is beginning to receive the limnological attention it deserves, since the foundation there of the Estación Limnológica in 1938 by the Departamento de la Marina Nacional. Before the Conquest it was the center of the Tarascan civilization, roughly equatable culturally and chronologically with Aztec, although independent politically and linguistically. The ruins of Tarascan cities are known at various sites in Michoacán,[19] in particular at Tzintzuntzan and Ihuatzio on the shores of the lake.[20] The antecedents of this culture are virtually unknown,[21] but important elements of Teotihuacan culture stem from "Tarascan" sources,[22] and it may be surmised that the later civilization was built on a platform of "Upper Middle" culture which can eventually be correlated with Cuicuilco-Ticoman.[23]

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[16] Erdtmann, 1934*b*.
[17] Knox, 1942.
[18] De Buen, 1941.
[19] Pollock, 1936.
[20] Leon, 1904–1906, 1934.
[21] Caso, 1930; Noguera, 1931.
[22] Noguera, 1935.
[23] Ekholm, 1940.

The lake basin at present is a closed one, although there are indications from the fishes and amphibians that it was at one time connected with the Lerma drainage and thus in turn with the Valley of Mexico.[24] Erosion of the soft volcanic rocks of the basin is proceeding rapidly, and the lake is being filled with an extremely fine reddish silt which is moderately rich in organic matter.[25] There is no evidence that the lake was ever dry, but there are obscure suggestions of both a rise and a fall in water level within protohistoric times.[26]

The sections presented in Figure 7 are by no means complete; the deeper one includes only 6.2 meters of sediment, beyond which depth the borer could not be pushed by hand. The total thickness of the deposit must be several times greater. Yet in many lakes and bogs in the eastern United States six meters are enough to encompass the entire post-glacial history, and, while any estimate of the time represented in the Pátzcuaro boring is an unsupported guess, it seems improbable that such a thickness was laid down in less than one or two thousand years. The modern lake is obviously filling at a rapid rate, but this fact is almost certainly due to increased erosion since the Conquest. An acceleration in the deposition of mineral material should reduce the pollen content of a given volume of sediment. Pollen frequency records were not kept, since the various methods used make the calculation too complicated and unreliable, but it seems significant that only in the upper meter or two was any difficulty experienced in finding enough pollen to count. In the remaining samples the frequency was evidently high and fairly uniform. It seems not unreasonable to assume, then, that the upper meter or two represents 400 years, while the remainder records an unknown but appreciably longer time. Further study of the microfossils other than pollen may throw additional light on the rate of accumulation.

The vegetational history revealed by the diagrams is exceedingly uniform, yet there are changes which seem definite enough to be real. The initial picture obtained is of a forest of the montane type (the Mischwald of Reiche);[27] pine, oak, and alder predominate (pine is no doubt considerably overrepresented, as usual, due to the abundance and lightness of its pollen). It is difficult to decide whether the small but con-

[24] See Meek, 1904, and De Buen, 1940, for lists of fishes. The fauna includes an endemic axolotl, *Bathysiredon dumerilii* (Dugès). Dunn, 1939; Lafrentz, 1930.

[25] Unpublished analyses by the author.

[26] For the fall in water level, see Villarello, 1909, Noguera, 1931; for the rise, see De Buen, 1941, pp. 34–35.

[27] Reiche, 1922.

stant proportion of fir pollen indicates a true approach to alpine conditions, or whether these grains reached the lake through a filter of montane species. The latter alternative seems more probable, and one has the impression that the conditions correspond to those now found at an elevation of 2500–3500 meters on the slopes of the Valley of Mexico. (Lake Pátzcuaro lies at an elevation of 2044 meters, Texcoco is at 2253 meters.)

Toward the middle of the sections evidence of desiccation appears in the form of more abundant pollen of grasses and herbs of the families *Chenopodiaceae* (or *Amarantaceae*) and *Compositae*. Genera of chenopods can not be distinguished, and the pollen type of the amaranths is similar; among the composites, tribes can be distinguished, and some of the grains seen are those of *Artemisia* (sagebrush). No doubt much desirable information is glossed over by the necessary lumping, yet it seems undeniable that the rise of the three families indicates more open conditions, corresponding to an upward shift of the montane forest of the order of 200–500 meters. Fir pollen became less abundant, and in the deeper boring, which was located in shallower water, an increase in the pollen of *Typha* (cat-tail) may imply a somewhat lower lake level.

Following this middle period there is little indication of further change except in one respect: chenopod pollen declined again. As there was little or no concomitant decline of grasses and composites, it seems impossible to decide, on the basis of the evidence, whether there has been a genuine increase in moisture or not. It is tempting, but altogether too dangerous, to assume that there has, and that the rise in lake level mentioned by De Buen belongs to this period.

Of great interest is the occurrence of a few pollen grains of maize and agave, the former certainly and the latter probably due to agricultural activity. The number of grains is too small to permit the assumption that where they are lacking there was no agriculture, but these grains have not been reported before in pollen analysis and it is encouraging to know that they may be expected in future work.

It is surprising at first sight to find many of the typical steppe plants of Mexico unrepresented in the sections, even in recent times when we are sure that some are present in the basin.[28] A considerable number of these, such as mesquite, acacias, mimosas, cacti, madrona, anacahuita, etc., were included in the reference pollen collection, but were not encountered in the deposits. The reason evidently is that these plants are insect-pollinated.

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[28] Batalla, 1940.

Summarizing the pollen sequence, we have an earlier moist period characterized by pine, oak, and alder, followed by a drier period in which grasses, chenopods, and composites became more abundant; these latter conditions may persist today, or there may have been an extremely slight shift toward increased moisture within (presumably) European times. In any case, all changes indicated are relatively insignificant, and not of the major sort that profoundly influences human culture.

An effort was made to link Tarascan culture to the pollen sequence by analyzing five samples taken in the wall of the excavation under one of the *yácatas* at Tzintzuntzan. The results were negative, no pollen being present. The failure was not unexpected, as the material did not appear promising even in the field. *Yácatas*, though stylistically peculiar to Michoacán, were built in much the same way as other Middle American structures, by heaping up soil and rubble and then facing the mound with cut stone. Any pollen occurring in the core material must have been present in the original deposit, and it was hoped that some of this material might have been obtained from old lake sediments. Evidently this was not the case in the *yácata* examined.

THE VALLEY OF MEXICO

It is obvious that, if cultures in the Valley of Mexico are to be dated by pollen analysis, the proper place for the borings which establish the standard pollen sequence is in the Valley, not 200 miles away in Michoacán. For two reasons, however, no borings were made in Lake Texcoco or any of the Valley lakes: both these reasons reduce to the single one that time and facilities were limited. In the first place, it was clear from experience in West Texas that the Hiller peat borer would not penetrate the sediments of a salt lake to any great depth. And in the second place, it was felt that the limnological as well as the stratigraphic aims of the trip would be best accomplished by concentrating on a lake that had not been tampered with by ancient and modern inhabitants. Much remains to be done in Lake Texcoco, but it can not be done by a single investigator in a week or two. It was therefore tentatively assumed that climatic changes in the Valley would be reflected in the Pátzcuaro basin, and that sooner or later archaeology would support or modify the correlation.

Samples for pollen analysis were taken at four of the key sites of the Middle Cultures[29] in the valley: at Zacatenco,[30] thirty-four samples in the neighborhood of Vaillant's Trench D system; at Copilco,[31] nine samples at new excavations now in progress under the lava; at Cui-

[29] Vaillant, 1941. [30] Vaillant, 1930. [31] Gamio, 1920.

cuilco,[32] nine samples in the tunnel under the lava on the east side of the mound, and two samples in a pit on the south side; at Ticoman,[33] one sample in the side of one of Vaillant's trenches, the identity of which could not be decided, as most of the trenches are no longer visible.

All the samples proved to contain so little pollen that reliable counts could not be made; many, however, showed from one to five grains per slide. The list of grains identified collectively is encouragingly long, including pine, oak, alder, grass, chenopods, and composites, the major categories expected on the basis of the Pátzcuaro analyses. Thus, if destruction of pollen by oxidation has taken place, there is no evidence that it was differential, and the explanation of the sterility of the deposits probably lies in their relatively rapid accumulation, which has overwhelmed the pollen with enormous amounts of soil colloids now very difficult to remove.

There are many indications that the various cultures known from the Valley of Mexico, including the Middle Cultures, were not indigenous to the Valley; Copilco-Zacatenco appears there fully developed and without antecedents, though it is as yet impossible to point to a region where its antecedents might be looked for;[34] Cuicuilco-Ticoman seems to have arisen to the east, perhaps in Puebla; Teotihuacan contains elements derived from at least four sources: "Tarascan," Cuicuilco-Ticoman, autonomous, and unclassifiable.[35] It will be the task of archaeological research to explore these leads more fully throughout Middle America.

Whether or not cultures are eventually fixed in a pollen sequence, pollen analysis is certain to offer a useful tool in the exploration, if only because it gives a stratigraphic correlation between regions. There is little doubt that climatic changes can be correlated from one closed basin to another throughout the southern Plateau region; they will be reflected in changing lake levels and in shifts in life zones up and down the surrounding mountains. It is interesting in this connection that the Valley lakes have experienced fluctuations of the same sort suggested for Lake Pátzcuaro, where, however, their chronological order is unknown. The Early Zacatenco period at the type site[36] ended with a rise in lake level, attested by a zone of rotted sherds. The Early Ticomanos evidently lived on the shores of a deeper lake,[37] but the lake level fell again before Conquest times. But, although these facts are worthy of notice, it would be unwise to use them as the basis of sweeping inferences, since changes of

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[32] Cummings, 1926, 1933.
[33] Vaillant, 1931.
[34] Vaillant, 1935*a*, 1938.
[35] Noguera, 1935.
[36] Vaillant, 1930, 1935*b*.
[37] Vaillant, 1931.

lake level are not always of climatic origin, especially in a volcanic region. The indications of a second flood stage, recorded at San Juanico but not at El Arbolillo,[35] are also disturbing, and it is obvious that more data are needed. At the moment, the stratigraphic work of archaeologists in the Valley of Mexico, magnificent as it is, leaves us only at the threshold of important future discoveries.

SUMMARY

This paper is in large part an essay on the prospects of pollen analysis as an adjunct to chronological studies in Mexican archaeology, and few concrete results are presented. Two borings, one 6.2 meters in length, in the bottom of Lake Pátzcuaro, Michoacán, have yielded a pollen sequence that gives indication of a dry period within recent, but probably prehistoric, times. This is only a first attempt at establishing a standard sequence for the southern Plateau region, since the borings are too shallow, too few in number, and too far from the archaeologically well-known Valley of Mexico. Efforts to fit the Middle Cultures of the Valley into the sequence through analysis of samples from the type sites failed because of the paucity of pollen, but it is believed that wider application of the method will eventually result in the discovery of cultural deposits offering conditions more favorable for such studies.

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[35] Vaillant, 1935*b*.

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The Rice Institute
Houston, Texas
March, 1943

METHODS FOR THE IDENTIFICATION OF THE LEAF FIBERS OF MESCAL (*AGAVE*), YUCCA (*YUCCA*), BEARGRASS (*NOLINA*) AND SOTOL (*DASYLIRION*)

WILLIS H. BELL and CARL J. KING

IN THIS study, an examination has been made of the leaf fibers from various species of the genera *Agave*, *Yucca*, *Nolina* and *Dasylirion* in order to establish a technique and to present a set of diagnostic characters which can be used in the identification of archaeological material suspected of containing such fibers.

The split leaves of various species belonging to these genera have been used widely by the aboriginal inhabitants of the American Southwest in the manufacture of sandals, mattings, and baskets. The fibers extracted from their leaves were made into cordage, which was employed in the manufacture of a great variety of articles.

Archaeologists are continually encountering this material and identifying it on the basis of its gross or external appearance, yet, so far as the authors have been able to ascertain, no one has described a convenient method of identification. Castetter, Bell, and Grove[1] and Bell and Castetter[2] have published papers summarizing the extent and manner of utilization of *Agave*, *Yucca*, *Dasylirion*, and *Nolina* by the aboriginal inhabitants of the American Southwest. In the identification of the genera and species used prehistorically, they have proceeded by checking the geographical distribution of the various genera and species against the locality from which archaeologists had reported their specimens. While these authors have been conservative in the identifications which they have accepted, they have been forced to work without more scientific criteria for the identification of material belonging to these common Southwestern genera.

Dodge[3] has reported on the fibers of the genera under consideration, but this study dealt with the gross characteristics and properties of the fibers rather than with any microscopic characteristics which might be of infallible value in fiber identification.

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[1] E. F. Castetter, W. H. Bell and A. R. Grove, *The Early Utilization and the Distribution of Agave in the American Southwest*, University of New Mexico Bulletin, Biological Series, Vol. 5, No. 4, 1938.

[2] W. H. Bell and E. F. Castetter, *The Utilization of Yucca, Sotol, and Beargrass by the Aborigines of the American Southwest*, University of New Mexico Bulletin, Biological Series, Vol. 5, No. 5, 1941.

[3] C. R. Dodge, *A Descriptive Catalogue of Useful Fiber Plants of the World*, Bureau of Fiber Investigation, Report No. 9, U. S. Department of Agriculture, 1897.

METHOD

Since no previous material on the subject seems to have been published, the authors decided to establish a method for the identification of fibers from the leaves of the genera under consideration, based on those constant anatomical characteristics known to be quite free from environmental influence. This method of attack proved of great diagnostic value, and it appears that a set of constant criteria for the identification of the fibers of *Agave*, *Yucca*, *Dasylirion* and *Nolina* has been secured.

One method used in identifying these fibers consisted in the study of cross sections of the entire leaf, or of cross sections of split leaves. The cross sections of the vascular bundles and the arrangement of their accompanying fibers were studied and drawn with the aid of a camera lucida.

This method cannot be used to identify individual fibers, but it is the most satisfactory method of identifying groups of fibers and their accompanying vascular tissue. Whenever a small portion of leaf tissue is encountered in sandals and basketry, this method is extremely useful, and the regularity with which it can be used in identifying cordage is surprising. This is true because the fiber in cordage does not consist of individual fibers, but is, rather, composed of groups of fibers and accompanying vascular tissue.

All cross sections were prepared by the freehand method with a single-edged safety-razor blade. The material was held firmly in the left hand and cut with a long, oblique stroke in the direction of the body, after which it was placed in water. It was then possible to study this material for short periods of time by placing the sections on a clean glass slide and covering them with a drop of water and a cover slip.

In order to preserve the sections permanently in a condition as nearly normal as possible, the following series of fixing and clearing agents were successively employed:

50% alcohol	2 hours
70% alcohol	2 hours
95% alcohol	2 hours
absolute alcohol	4 hours
equal parts absolute alcohol and xylol	4 hours
xylol	2 hours

The sections were then placed on a glass slide and covered with a large drop of Canada balsam and a cover glass. Cross sections of the vascular bundles and accompanying vascular tissue were then examined under

the microscope and the tissues were drawn with the aid of a camera lucida.

A second method was devised for the identification of the individual fibers of which cordage is sometimes composed, as well as of poorly preserved archaeological material.

Samples of fiber from the leaves of *Agave*, *Yucca*, *Dasylirion*, and *Nolina* were immersed in a 10 per cent solution of potassium hydroxide for eighteen hours, in order to facilitate maceration and prevent the breaking of individual fibers. The fibrous material was placed on a glass slide and macerated by the use of friction, applied with a spatula. A drop of water was then placed on the mass, the material was further teased apart by the use of two needles, and a cover slip was added.

Using the microscope and camera lucida, one hundred measurements of individual fibers were taken near the midpoint of each cell to determine the average width of the fiber, the average width of the cell wall, and the average width of the lumen for each species. Drawings were made of representative species of each genus studied, and a key was formulated to distinguish between the individual fibers of the four genera.

A third method was employed to ascertain whether microchemical differences exist among fibers of the various genera.

To determine which genera possessed lignified fibers, a few drops of a 5 per cent phloroglucin solution were applied to a group of fibers and a drop of dilute hydrochloric acid was added simultaneously. The appearance of a red coloration in the cell walls indicates the presence of lignin.

A few drops of a 1 per cent methylene blue solution were applied to other macerated fibers in order to detect the presence of any cellulose in the cell walls of the various fibers. The cellulose nature of the walls is denoted by the blue color produced within them.

DISCUSSION

1. Cross sections were made of the leaves of *Yucca glauca* Nutt., *Y. thompsoniana* Trel., *Y. elata* Engelm., *Y. torreyi* Shafer., *Y. carnerosana* (Trel.) McKelvey, and *Y. baccata* Torr. The relationship of the vascular tissue to the accompanying fibers is characteristic of the genus, and no distinction between individual species can be discerned.

In cross section, the leaves of the various species of *Yucca* possess fibrous bundles distributed rather generally throughout the mesophyll (Fig. 8, *1a*). These bundles may consist of groups of xylem and phloem, capped above and below with fibers (Fig. 8, *1b*, *1c*), or they may be composed of fibers without any associated vascular tissue. Of these two types of bundles, the former is very characteristic of the genus and is therefore extremely useful in identification.

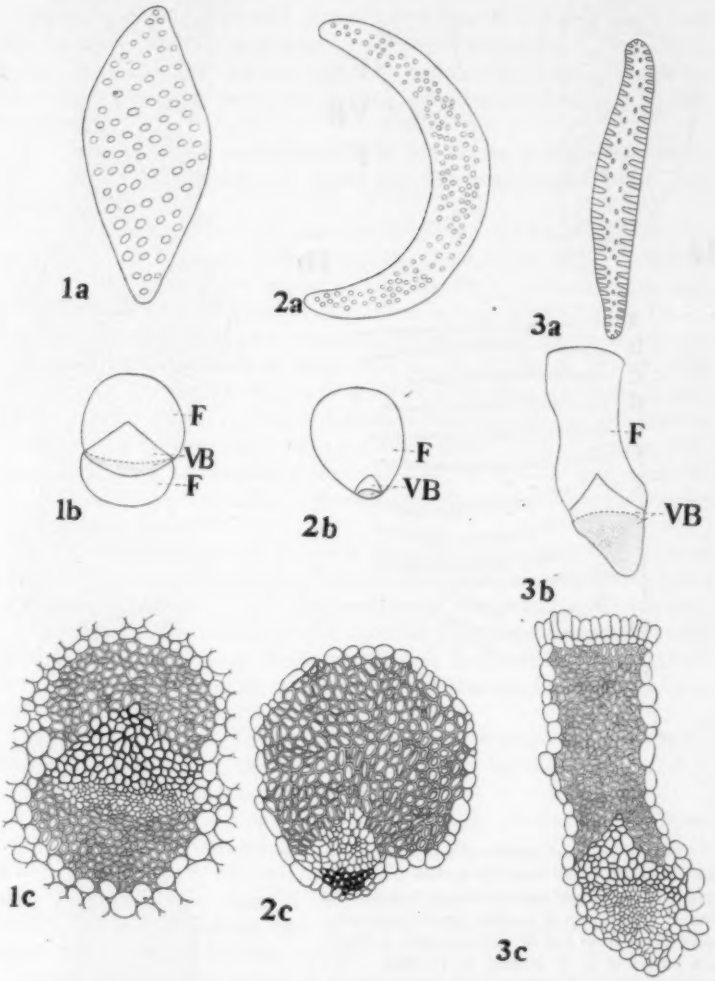
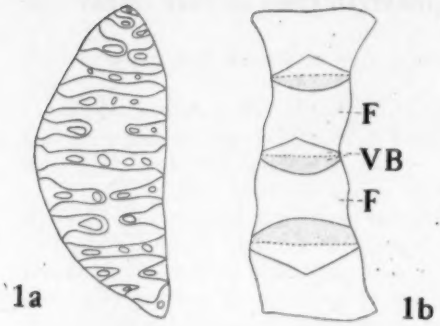
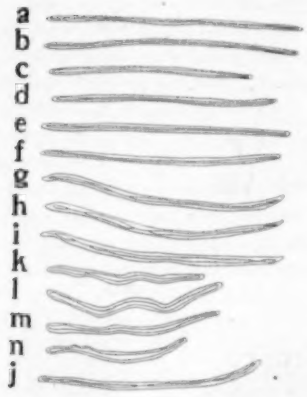


FIG. 8.—Cross section of vascular bundles and associated fibers from leaves of *1a, Y. elata; 2a, A. lechuguilla; 3a, D. wheeleri.* Diagrams of cross sections of leaves of same species in *1b, 2b, 3b.* Diagrams of vascular bundle and associated fibers from leaves of same species in *1c, 2c, 3c.* VB—Vascular bundle, F—fibers.





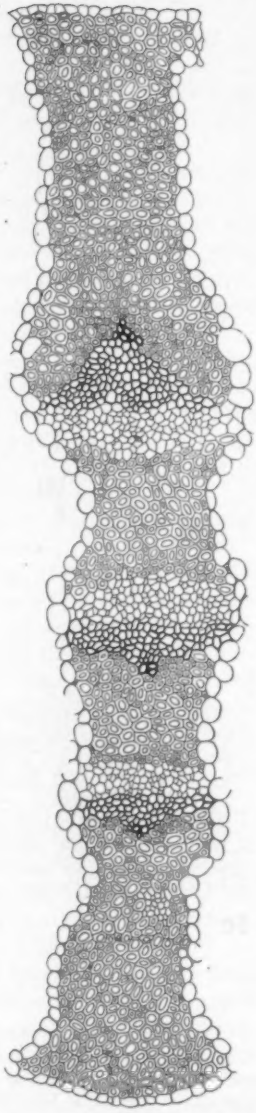


FIG. 9.—*1a*, cross section of vascular bundle and associated fibers from the leaf of *N. microcarpa*; *1b*, diagram of cross section of leaf of same species; *1c*, diagram of vascular bundle and associated fibers from leaf of same species. *2*, fibers from leaves of *a*, *Y. glauca*; *b*, *Y. elata*; *c*, *Y. thompsoniana*; *d*, *Y. torreyi*; *e*, *Y. carneosana*; *f*, *Y. baccata*; *g*, *N. texana*; *h*, *N. erumpens*; *i*, *N. microcarpa*; *j*, *D. wheeleri*; *k*, *A. lechuguilla*; *l*, *A. parryi*; *m*, *A. scabra*; *n*, *A. neomexicana*. VB—Vascular bundle, F—fibers.

Of the four genera studied, it was found that only *Yucca* has a vascular bundle capped on both sides by a group of fibers (Fig. 8, *1b*, and *1c*). Samples of prehistoric sandals, basketry, and cordage were analyzed by this cross-sectional method, and positive identification as to plant genus was secured.

2. Cross sections were prepared from the leaves of *Agave lechuguilla* Torr., *A. parryi* Engelm., *A. scabra* and *A. neomexicana* Woot. and Standl.

In cross section, the vascular bundles from leaves of the several species are found scattered throughout the tissue of the leaf (Fig. 8, *2a*), and the vascular anatomy of the various species is so closely alike that differentiation between species of the genus is impossible. Unlike *Yucca*, the vascular tissue of *Agave*, instead of being capped above and below with fibers, is surrounded on three sides by fibers (Fig. 8, *2b*, *2c*). This difference in the characteristics of individual bundles, in cross section, makes possible the separation and positive identification of both genera.

Samples of archaeological material were studied in cross section, and, since such material contained fibers still in association with vascular tissue, it was always possible to determine with certainty whether or not *Agave* was represented.

3. Cross sections of the leaves of *Dasylirion wheeleri* S. Wats. were examined, and the vascular bundles were found to be arranged in rows just beneath both of the two flat surfaces of the leaf (Fig. 8, *3a*). Any one of these bundles contrasts with those of *Yucca* and *Agave* in that the fibrous mass of *Dasylirion*, in cross section, is elongated instead of spherical, and the fibers enclose one vascular bundle, usually near the inner end of the mass (Fig. 8, *3b*, *3c*).

Archaeological material in which *Dasylirion* is represented normally contains split leaves so that a cross section of a bundle can be secured and positive identification can be made.

4. Finally, cross sections were prepared from the leaves of *Nolina texana* S. Wats., *N. erumpens* (Torr.) S. Wats. and *N. microcarpa* S. Wats. The masses of fibrous tissue, in cross section, are elongate and often extend from the upper to the lower surface of the leaf (Fig. 9, *1a*). Unlike *Dasylirion*, each group of fibrous tissue characteristically encloses more than one vascular bundle (Fig. 9, *1b*, *1c*).

Using the anatomy of these fiber groups as a criterion, positive identification was made of archaeological material in which *Nolina* was employed.

The authors have found that the use of cross sections is very feasible and extremely reliable in the identification of archaeological material. All basketry, as well as most cordage, is found to contain vascular bun-

dles in association with fibers, and, when this condition is present, a cross section of the material enables one to determine positively whether or not any of the four genera studied was employed. If the specimen is very poorly preserved and the anatomical characters of the vegetal material are obliterated, this means of identification, as well as others considered in this paper, are not usable.

The second method employed in this study was an attempt to ascertain the characteristics of the individual fibers of *Yucca*, *Agave*, *Dasylirion* and *Nolina*.

Some material was macerated by teasing the fibrous mass in water, other material was soaked for eighteen hours in a 10 per cent solution of potassium hydroxide and then macerated, while still other fibers were macerated after having been treated for forty-eight hours in a 10 per cent solution of potassium hydroxide.

After repeated tests, the fibers which had been immersed for eighteen hours in a 10 per cent solution of potassium hydroxide were chosen as the most suitable for study and identification. This eighteen-hour treatment made it possible to separate the individual fibers without materially altering any of their normal anatomical characteristics and also facilitated the removal of excess cells from around the fibers.

The identification of fibers which had been treated with potassium hydroxide for forty-eight hours was extremely difficult, because the lumen of the cell was often obliterated by the swelling of the cell wall or the cell walls became distorted in size and shape.

When the fibers were macerated without first being treated with potassium hydroxide, the walls would sometimes be broken or distorted to such an extent as to make identification impossible. This was especially true of *Yucca*, the identification of which was sometimes confused with that of *Dasylirion*.

On the basis of the anatomical characteristics of the individual fibers, it is possible to distinguish between the four genera. However, the individual fibers from the several species of any one genus are so nearly alike that it is impossible to distinguish between any of the species belonging to that genus, except in the genus *Yucca*, where the characteristics of the fibers from the thick, fleshy-leaved species are found to resemble each other, as opposed to the fibers of the thin-leaved species, which in turn resemble one another.

1. The thin-leaved *Yucca glauca*, *Y. elata*, and *Y. thompsoniana* have a cell wall which is equal to the lumen in thickness (wall/lumen = 1/1) (Fig. 9, *2a*, *2b*, *2c*), while the thick-leaved *Y. torreyi*, *Y. carnerosana*, and

Y. baccata possess a wall which is twice the thickness of the lumen, (wall/lumen = 2/1) (Fig. 9, *2d*, *2e*, *2f*).

The individual fibers of all species of *Yucca* taper regularly to the rounded end and the lumen is usually very distinct, with little variation in its diameter throughout the entire length of the cell (Fig. 9, *2a–f*).

2. The individual fibers from the leaves of *Agave lechuguilla*, *A. parryi*, *A. scabra*, and *A. neomexicana* have crooked outlines as compared with the straight fibers of all the other genera (Fig. 9, *2k–n*). Many of the fibers of *Agave* species appear to be strongly striated and have a lumen varying in width from several times that of the cell wall to a diameter of much less than that of the thickness of the wall (Fig. 9, *2k–n*). The individual fibers of *Dasylirion* (Fig. 9, *2j*) and *Nolina* (Fig. 9, *2g–i*) are also characterized by an irregular lumen, but fibers from *Agave* can be clearly distinguished from those of all other genera because of the fact that they alone are variously curved in outline (Fig. 9, *2k–n*).

3. Individual fibers from the leaves of *Dasylirion wheeleri* are straight in outline and the lumen may be very wide, as compared to the cell wall, but more often its diameter is less than the thickness of the cell wall, and in some places the lumen becomes so narrow as to appear non-existent (Fig. 9, *2j*).

In the width of the single fibers and the width of the lumen, *Dasylirion* may sometimes resemble the thin-leaved species of *Yucca* (Fig. 9, *2a–c*). However, the various species of *Yucca* (Fig. 9, *2a–f*) have a lumen which is uniform in diameter and clearly distinct throughout the length of the fiber, while the diameter of the lumen in *Dasylirion* (Fig. 9, *2j*) is irregular and, at some places in the fiber, appears entirely obliterated except for a faint line.

4. Fibers from the leaves of *Nolina texana*, *N. erumpens*, and *N. microcarpa* are very slightly bent near the end, and one wall of the fiber tapers more to the blunt end than does the opposite wall (Fig. 9, *2g–i*). The average width of the lumen varies in diameter, being very wide at some places and then narrowing in others to such a degree that it appears non-existent (Fig. 9, *2g–i*). In those lengths of the fiber where the lumen is moderately regular in outline, without narrowing or widening abruptly, the diameter of the lumen is about equal to the thickness of the wall (Fig. 9, *2g–i*).

The irregular diameter of the lumen is a characteristic of the crooked fibers of *Agave* (Fig. 9, *2k–n*) and the straight fibers of *Nolina* (Fig. 9, *2g–i*) and *Dasylirion* (Fig. 9, *2j*). The fibers of *Agave*, as mentioned before, are variously curved, while those of *Nolina* and *Dasylirion* are relatively straight in outline. The lumen in the fibers of *Agave* is always

distinctly visible (Fig. 9, *2k–n*), while the lumen in the fibers of *Nolina* (Fig. 9, *2g–i*) and *Dasylirion* (Fig. 9, *2j*) narrows in some places to such an extent that it appears merely as a faint line. This characteristic of the lumen is specific for the two latter genera. A difficulty therefore arises in separating the individual fibers of *Nolina* from those of *Dasylirion*, but measurements of one hundred fibers of the several species revealed the following average diameters: *N. texana*, 0.018 mm.; *N. erumpens*, 0.015 mm.; *N. microcarpa*, 0.0175 mm.; and *D. wheeleri*, 0.0125 mm. Thus, the fibers of *Nolina* are all of comparatively greater average diameter than those of *Dasylirion*. This distinction is so marked, when one has familiarized himself with the diameters of the two genera, that positive identification of archaeological material containing *Nolina* and *Dasylirion* was made easily by observing the individual fibers.

If identification of archaeological material is to be made from the individual fibers of these two genera, it is suggested that permanent slides of species from both genera be prepared and that these be used as a check against the specimen under consideration. However, it is easier to make positive identification of material containing *Nolina* and *Dasylirion* by a study of cross sections of the material. It is usually possible to do this, since most of the archaeological specimens in which the two genera were employed are composed of entire leaves or split sections of leaves.

It was hoped that by the use of the third method employed in this study, that is, the treatment with phloroglucin and methylene blue, microchemical differences in the fibers would be detected. It was thought, at first, that some genera might disclose fibers with cellulose walls and that others might show lignified fibers. If this had proved true, the method would have been useful in identification. However, lignified vascular tissue is in intimate association with cellulose fibers in all genera, and, consequently, no useful microchemical differences have been found to exist.

There are presented in this study, then, two means of identification for archaeological material suspected of containing *Agave*, *Yucca*, *Nolina*, and *Dasylirion*. Neither method goes so far as to identify the particular species used, but the ability to determine the genus and a knowledge of the common species in an area make it possible, in most cases, to be certain of the specific plant used.

KEY FOR THE DETERMINING OF CERTAIN FIBERS

Fibers treated with 10 per cent KOH solution for eighteen hours

A. Fiber curved ..... *Agave.*

AA. Fiber not curved

B. Lumen clearly distinct throughout its entire length.
  C. Lumen as wide or wider than the wall. The ratio of wall/lumen = 1/1..... Thin-leaved species of *Yucca*.
  CC. Lumen present and clearly distinct throughout the length of the fiber, but extremely narrow. The ratio of wall/lumen = 2/1.....Thick-leaved species of *Yucca*.
BB. Lumen at some places narrowing to such an extent that its cavity appears non-existent.
  C. Average width of fiber between 0.015 mm. and 0.0185 mm.....*Nolina*.
  CC. Average width of fiber less than 0.014 mm.....*Dasylirion*.

FIBERS TREATED WITH 10 PER CENT KOH SOLUTION FOR EIGHTEEN HOURS

Fiber	*Average Width of Fiber (in mm.)*	*Average Width of Wall (in mm.)*	*Average Width of Lumen (in mm.)*	*Straight or Curved*
Yucca glauca	0.0125	0.004	0.0049	S
Yucca elata	0.012	0.004	0.004	S
Yucca thompsoniana	0.01	0.0035	0.003	S
Yucca torreyi	0.011	0.0044	0.002	S
Yucca carnerosana	0.013	0.005	0.003	S
Yucca baccata	0.012	0.005	0.002	S
Nolina texana	0.018	0.0065	0.005	S
Nolina erumpens	0.015	0.005	0.005	S
Nolina microcarpa	0.0175	0.0059	0.0048	S
Dasylirion wheeleri	0.0125	0.0043	0.0042	S
Agave lechuguilla	0.016	0.0045	0.007	C
Agave parryi	0.015	0.0046	0.0049	C
Agave scabra	0.017	0.005	0.007	C
Agave neomexicana	0.0165	0.005	0.0065	C

The above figures were obtained by computing the average of one hundred treated fibers.

SUMMARY

1. The following characteristics of the four genera studied are extremely useful in establishing their identity through the study of cross sections of their leaves or parts of leaves.

Yucca has scattered vascular bundles, each of which is capped on two sides by a group of fibers, while *Agave* has scattered vascular bundles surrounded on three sides by fibers. On the other hand, *Dasylirion* has groups of fibrous tissue which are elongate instead of spherical in cross section and which are located near both of the two flat surfaces of the leaf. *Nolina*, like *Dasylirion*, has elongate fibrous tissues which often extend from the upper to the lower surface of the leaf, but, unlike *Dasy-*

lirion, each group of its fiber tissue encloses more than one vascular bundle.

2. A study of cross sections is an excellent method of identifying the materials in sandals and basketry, where whole or split leaves were used, as well as for identifying a majority of the cordage to be found in archaeological excavations. This method is also the easiest and surest means of identification.

3. The individual fibers of the four genera studied have the following characteristics:

Yucca fibers taper regularly to the rounded end. The lumen is usually distinct and varies little in diameter throughout the entire length of the fiber. The thin-leaved species of *Yucca* have a wall equal in diameter to the lumen (wall/lumen = 1/1), while the thick-leaved species of *Yucca* have a wall twice as thick as the lumen (wall/lumen = 2/1).

The individual fibers of *Agave* are unique in being slightly crooked.

The lumen of individual fibers of *Dasylirion* may be very wide as compared to the diameter of the cell wall, but more often its width is less than the thickness of the cell wall and in some places the lumen becomes so narrow as to appear non-existent.

In the fibers of *Nolina*, the lumen varies in diameter, being very wide in some places and narrowing in other places to such an extent that it appears obliterated.

Although *Nolina* and *Dasylirion* may be confused with each other, it will be found that the fibers of Nolina are of greater diameter than those of *Dasylirion*. Also, when encountered in archaeological material, a cross section can usually be secured for positive identification.

4. Tests for cellulose or lignin in the walls of the fibers are not useful in identification, because cellulose fibers and lignified vascular tissue are in close association in all four genera.

University of New Mexico
Albuquerque, New Mexico
March, 1943

POTTERY TYPES OF THE MANUELITO DISTRICT*

ERIK K. REED

INTRODUCTION

TRAVELERS bound east up the Puerco Valley on Highway 66, or on the Santa Fe Railroad, come into New Mexico from Arizona as they enter a pass through a red sandstone cliff which runs north and south just east of Lupton. Petroglyphs, probably of Basketmaker origin, and

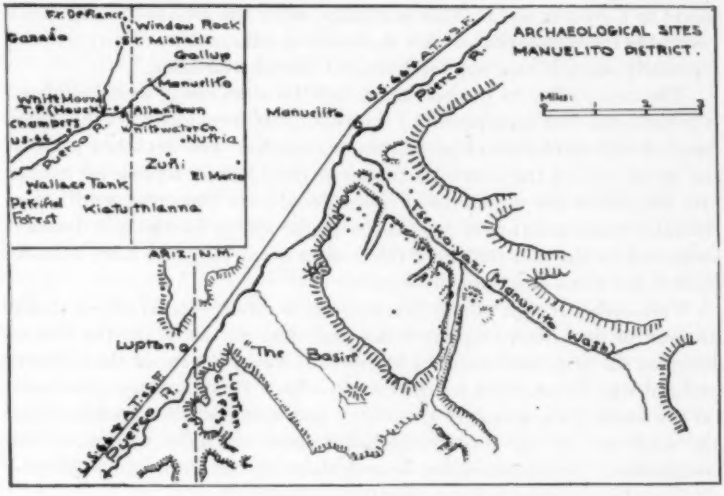


FIG. 10.—Map showing location of archaeological sites in the Manuelito district.

pictographs, probably of Navaho origin, ornament caves and coves in the west-facing cliff. Basketmaker III rough pottery (Lino gray) and occasional sherds of typical modern Navaho and Zuñi pottery are found. Basketmaker slab-cists and indications of pit houses occur below the cliff. Occupied Navaho hogans of horizontal logs dot the little valley.

The only evidence of human occupation in this subdivision of the Manuelito area between the eighth century and the coming of the Navaho is a single small foothill site, situated in the midst of Basketmaker remains. The low stone mound, 60 feet long and 10 feet wide, evidently represents a single tier of contiguous rectangular masonry rooms.

* Published with assistance from the Southwestern Monuments Association for illustrations.

A circular kiva is probably present in front (southeast) of the house-row. The pottery is mainly Late Developmental or Pueblo II[1] black-on-white and gray corrugated, and there are a few sherds of Wingate Black-on-red and of a single Bluff Black-on-red jar.

The mile-wide basin which lies just west of these cliffs, to the southeast of the travel route and a mile inside New Mexico from the state line, apparently was even more sparsely inhabited in prehistoric times. A single stray sherd of Woodruff Brown is the only archaeological material found in the basin so far. This is strange, since the area seems especially favorable for occupation, with a relatively permanent water supply, and especially since it now supports several Navaho families.

The next valley to the northeast and the mesa rising westward from it to form the east escarpment of the basin just mentioned are, however, covered with evidences of prehistoric occupation. The detached *peñol* at the north end of the east escarpment of the basin is topped by a large late site, there are numerous sites scattered over the mesa, and a considerable concentration of population in the valley to which it drains is indicated by the fact that over thirty sites of varying size have been recorded and others are known to exist.

This valley is that of the Tse-ko-yazi, or Manuelito Wash; it drains an area of over thirty square miles and runs northwest to the Puerco River at the little settlement of Manuelito, New Mexico, on the highway and railroad fifteen miles southwest of Gallup. There are two great ruins on the southwestern side of the valley and many smaller pueblos along the wash and on the nearby ridges for about six miles upstream from Manuelito. The upper valley is underlain by the impervious Mancos shale and is unsuitable for agricultural occupancy.

Basketmaker sites are notably rare, so far as known, although Lino pottery occurs in minor quantities at half a dozen pueblos. Two main periods of occupation are indicated by two major groups of pottery. One can be designated as "Developmental-Early Classic," or Pueblo II-early III. It is found at a dozen sites alone, or only with earlier material, and at half a dozen sites occupied later and yielding also materials of the other main period. This second horizon, representing classical Pueblo III of the late thirteenth century, and referred to herein as the Kintiel focus, consists primarily of two general pottery types discussed below, Klageto Black-on-white and Klageto Polychrome, with variations. The previously published list of types for the "Kintiel phase" does not entirely correspond, but is obviously intended for this same group.[2]

[1] For this period classification see Roberts, 1939, 1940.

[2] Gladwin, 1934, Fig. 4. "Kintiel phase: Kintiel Black-on-white (42. Degenerate Tularosa Black-on-white), Chaco Black-on-white, Puerco Black-on-red (41. Intermediate

A few small sites occur on the main mesa south of the Manuelito area, a feature of which the mesas and cliffs seen from the highway and along the Tse-ko-yazi are outlying dissected remnants. Sherd collections from two sites on the south mesa consist of Developmental-Early Classic Black-on-white.

Many sites are undoubtedly to be found north of the Puerco River and the travel route along it. Only one, LA 1483 at Santa Fe Springs, just north of Manuelito has, however, been definitely recorded. The sherds from it are of the Kintiel horizon.

The two big sites on the Tse-ko-yazi are of both horizons, Developmental-Early Classic and Kintiel. A superkiva about 75 feet in diameter is indicated at one of them. Both are in semi-defensive locations and are enclosed by defensive walls. Two smaller sites in highly defensive locations are of the Kintiel focus. There are several small sites of the same ceramic composition near each of the big ruins.

Aside from the pottery types indicated by surface collections and the major architectural features observable as surface remains, very little is known directly of the archaeology of the Manuelito district, since no scientific excavations have been made. Inferentially, the culture of the earlier periods may be presumed to have been not unlike that revealed by the excavations of Dr. Frank Roberts at sites of comparable ceramic composition not far away to the southeast at Nutria,[3] and to the southwest at the Long H Ranch[4] and Allantown.[5]

The pottery is treated in some detail below. The obvious architectural features include stone pueblos of fairly good masonry; circular kivas, probably including the superkiva; and defensive placement. Stone axes, arrow points, metates and manos, and other implements, and bone awls and similar tools, are to be expected and are indicated by occasional surface finds of fragments. Inhumation of the dead is indicated by human bones strewn about pot-hunters' excavations and, in a few cases, observed washing out of slopes; a flexed position is probable, since it occurs consistently at the sites excavated by Roberts mentioned above.

The Kintiel focus or "phase" is virtually unknown, however; none of Roberts' sites extend so late in ceramic time, and sites of similar ceramic composition further away, to the northwest, have not been extensively

between Wingate Black-on-red and St. Johns Polychrome), Puerco Indented Corrugated (37. Grey colour; deep indentations). Large pueblos. Date, 1275." The discrepancies in the pottery are bad, but the place and time are the same. Neither Chaco Black-on-white nor Puerco Black-on-red occurs, and Puerco Black-on-red is not transitional to St. Johns anyway; but Gladwin's "Kintiel Black-on-white" is probably Klageto-Wide Ruin Black-on-white. The redware of this focus is late St. Johns-Klageto Polychrome. I prefer "focus" to Gladwin's "phase," for the reasons given in Colton, 1939.

[3] Roberts, 1932. [4] Roberts, 1931. [5] Roberts, 1939, 1940.

investigated. Test excavations at one such site, Kintiel itself, revealed rectangular kivas of the "Hopi" or "platform" type.[6] The rectangular kiva spread from central Arizona to the Hopi and Zuñi regions in the thirteenth century, together with the 3/4-grooved axe; whether these western traits reached the Manuelito district is not known.

UTILITY POTTERY

Plain or corrugated unpainted pottery is often referred to as utility or culinary ware. Only unslipped and unpolished reduced-fired material —i.e., grayware—is so considered here; the few sherds, presumably intrusive, of polished brownware (mostly with smudged interiors) and plain red (slipped and polished) are grouped with other, painted, redware.

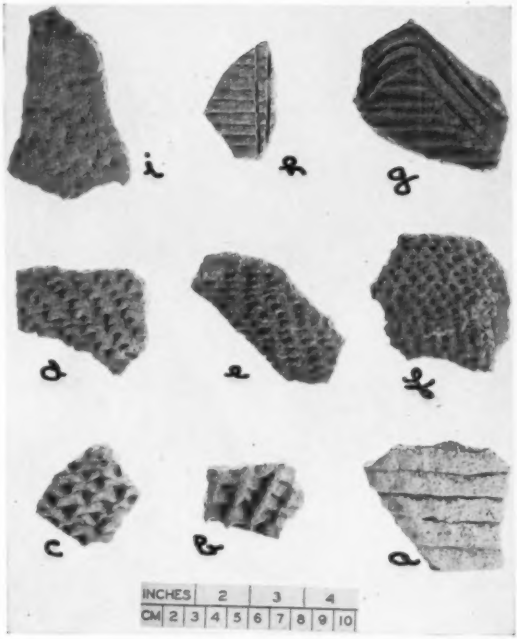
The culinary ware then falls in two main groups (aside from the thin, dark gray, scored jar sherds identifiable as modern Navaho): plain rough gray and coil-ornamented, or corrugated, gray. Considerable variation is to be seen in the corrugated sherds, but the plain gray is almost all of one sort, which may be broadly classified as Lino Gray.

This material is generally pale gray, often almost white, sometimes with a faint yellowish cast. Some sherds, especially jar exteriors, are a darker shade of light gray. It is coarsely and conspicuously tempered with what appears to be fine stream-worn gravel, mostly quartz sand. A few sherds are sparsely tempered. Surfaces are rough and bumpy. Scraping marks show on most sherds, with occasional tracks cut by temper dragged along the surface. The paste or core is generally the same color as the surfaces, but there are a few instances of dark core and white surfaces, obviously due to firing conditions rather than slipping. Thickness varies between 2 and 10 mm.; the average appears to be about 5 mm. Thickness will vary from 3 to 5 mm., or from 5 to 8, on a single small sherd. Rims of typical large jars are commonest; "seed-jar" rims and incurved bowls are evenly divided in the small collection.[7]

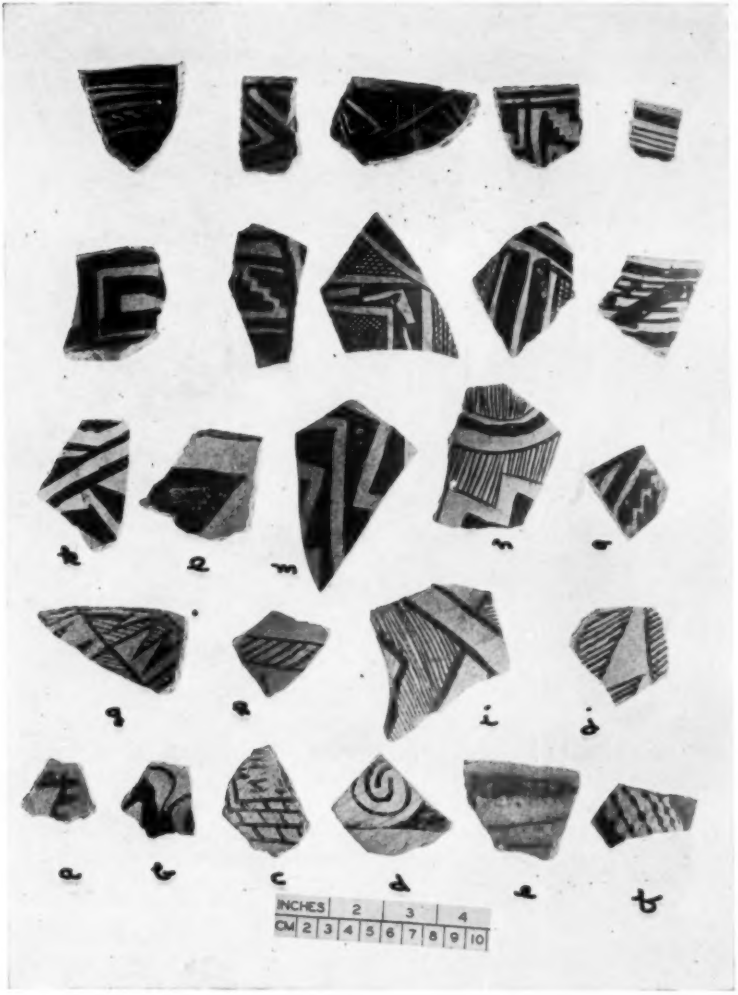
This material seems essentially similar to "Lino Gray" from other areas to the north and northeast, and it fits fairly well the published description of Lino Gray in the Flagstaff area.[8] The white rather than gray surface color is a variation noted also in the Petrified Forest area fifty miles to the southwest.[9]

Plain gray or white sherds not of the above category include a few undecorated fragments from the bottoms of black-on-white bowls and three sherds of uncertain identification requiring separate mention. One is a jar rim very like the Lino group, but well made and finely-tempered. The other two are rims of bowls, both sherds sufficiently large to suggest

[6] Haury and Hargrave, 1931, pp. 83–95.
[7] Cf. Roberts, 1940, Pl. 2.
[8] Colton and Hargrave, 1937, pp. 191–192.
[9] Mera, 1934, p. 7, and personal observation.



Grayware. *a*, Kana-a Gray (Pueblo I banded-neck); *b*, *c*, highly exuberant style corrugated; *d*, flat-wavy corrugated, sand temper; *e*, *f*, compact style corrugated, sherd temper (Little Colorado Corrugated); *g*, clapboard coil, ornamental arrangement; *h*, incised lines across clapboard coil; *i*, smeared and flattened, corrugations nearly obliterated.



Whiteware. *a–c*, La Plata Black-on-white (Basketmaker III Black-on-gray); *d–f*, Chaco 1 Black-on-white (Pueblo I); *g–j*, Chambers Black-on-white (Chaco 2, *ca.* 1100); *k*, Snowflake Black-on-white (1100–1200); *l*, *m*, Puerco Black-on-white (Chaco 2, *ca.* 1100); *n*, Tularosa Black-on-white (*ca.* 1100–1200); *o*, Flagstaff Black-on-white (1125–1200). *Top two rows*, Klageto Black-on-white (*ca.* 1250–1300).

absence of decoration on the whole vessel. Both are thinly white-surfaced with dark cores, apparently not actually slipped. One has a well-polished interior and finely divided white temper. The other is partly polished, with coarser sherd temper. Both are evidently undecorated black-on-white, similar in all other respects to the typical painted ware.

Some of the corrugated grayware is in general almost identical with Lino Gray save for the surface treatment. The temper is less coarse in many cases, but often the core and inner surface are indistinguishable from those of the plainware. Temper is generally conspicuous even on the exterior corrugations. The tempering material is waterworn quartz sand.

A hardly less abundant group of corrugated ware is quite different. The paste is finer and more compact, as if the clay had been more thoroughly kneaded; the finely-divided whitish temper consists of ground sherds plus a little sand; and the core is frequently brownish.

Variations in treatment appear in both groups, but there is a certain degree of correlation between style of corrugation and composition. Notably, a few rim sherds of flat coils, entirely unindented, are identical with Lino Gray and manifestly represent Pueblo I coil-neck pitchers.[10] Otherwise, sorting of the material resembling Lino Gray according to the degree of such resemblance—by coarseness of temper and roughness of interior surface—does not give a correlation with types of corrugation.

The majority of the sand-tempered group is typical indented-corrugated, in some cases interrupted by unindented coils.[11] Variations include only faintly waved, clapboard coils[12] and instances of both the flamboyant and compact styles mentioned under the prepared-temper group. Single incised lines drawn across the corrugation[13] and other variations of coiling occur.

The second group of corrugated ware includes no really typical indented-corrugated, but appears in three main variations. One is the style I am calling "flamboyant,"[14] another the style I am calling "compact."[15] Both of these occur also in the sand-temper group. The third style inclines toward both of these, and also toward typical indentation, but is smeared and flattened.[16]

[10] Cf. Roberts, 1940, Pls. 3–5, especially 3*b*. However, I have no examples from Manuelito of the tooled neck-coils comparable to Coconino gray illustrated in Pl. 4*a*.

[11] *Ibid.*, Pls. 6*a*, 7*a*, *b*, *d*.

[12] *Ibid.*, middle of Pl. 7*c*.

[13] *Ibid.*, Pl. 7*c*; incised designs identical; on indented coils in the Manuelito material.

[14] Approximately like Roberts, 1940, Pls. 6*b*, 8*c*. The term "exuberant corrugated" would include this extreme material, but is also used for fairly shallowly indented or "flat-wavy" normal corrugation.

[15] Not illustrated by Roberts, this style somewhat resembles Linden and other brown corrugated types, even approaching Elden corrugated in style of indentation.

[16] Not, however, in the style of Moenkopi Corrugated.

There are also a few examples of unindented or faintly waved clapboard coil, including one which is corrugated only to the shoulder like Medicine Gray.[17] This sherd could well be classified as Medicine Gray, since the temper is fine quartz sand, although the core is brownish.

The sand-tempered group seems similar in most characters to Tusayan Corrugated,[18] but it probably should be regarded as Chacoan. The sherd-tempered group is presumably to be included under Little Colorado Corrugated.[19]

The utility pottery as a whole seems very similar to the series from Allantown, about ten miles southwest, as indicated by my references to Roberts' illustrations. Roberts states, however, that his utility vessels are tempered with sand or ground quartz and pulverized sherds, the latter appearing in the banded-neck pitchers and increasing in the corrugated ware. The implication is clear that the varieties of tempering occur together in the same vessels, and no distinction is made between groups of variously tempered pottery.

A few plain gray sherds and coil-neck gray jar rims which I have from Allantown are quite distinct from my Manuelito material; they are finely tempered and smooth, with no temper protruding on either surface. The coarse white variety of Lino is unrepresented. Corrugated sherds from Allantown in my collection are too few for worthwhile study; those in collection LA 663, from the Allantown excavations, at the Laboratory of Anthropology are mainly of exuberant or "flamboyant" style, seem to be largely sand-tempered, and in general closely resemble the Manuelito material. Some of them are sparsely tempered with an unusually clayey core. A small group of utility sherds from Kintiel includes examples of the two groups described and of various styles of corrugation. Differences between Developmental-Early Classic corrugated ware and that of the later horizon are not immediately apparent.

BLACK-ON-WHITE TYPES

The earliest horizon of this series, the first painted pottery of the northern Southwest, appears in Basketmaker III times, about 450–750, and consists simply of black designs crudely applied to the basic group of the Anasazi sequence, the rough gray ware characteristic of the period, with no slipping and little polishing. The basic decorated pottery thus produced is divided into two main groups, Lino Black-on-gray (with carbon paint of vegetal origin) and "La Plata Black-on-white" (iron paint). No difference other than the type of paint is apparent. The iron-paint type is of eastern distribution, centering in northwestern New

[17] Colton and Hargrave, 1937, p. 199.
[18] *Ibid.*, pp. 196–197. [19] *Ibid.*, p. 233.

Mexico, and is the basic type of the Chaco-Puerco-Cibola black-on-white development comprising most of the pottery to be discussed.

As at Allantown,[20] the Basketmaker III black-on-gray from the Manuelito area is the Chacoan iron-paint type, or "La Plata Black-on-white." No discussion of paste, temper, etc., is needed, since these seem essentially the same as in the undecorated Lino. The painted pottery is less coarse and rough than most of the plain gray. Surfaces often were smoothed almost to the point of "floating," as at Allantown.[21] Designs on the relatively few sherds here include an example of the cursive squiggles or small repeated units, often identical with European alphabetic characters, which are typical of a later Hohokam type, Santa Cruz Red-on-buff (700 or 800 to 900 A.D.), as in other collections of La Plata or Lino Black-on-gray.[22] The Manuelito instance of this style consists of Russian etas (reversed capital N's). Other designs include simple arrangements of straight lines, dots, ticked lines, and lines composed of rows of triangles with small (possibly unintentional) hooks.[23] In contrast to the rock-tempered La Plata Black-on-white of the Mancos-La Plata district,[24] this material is, like Lino Black-on-gray, sand-tempered (15 sherds examined under the binocular microscope at 21 diameters).

Aside from the crude early material just discussed, the black-on-white pottery of the Manuelito district falls in two main groups—Developmental and Early Classic types, mostly of general "Chacoan" affiliation; and late, presumably thirteenth century, forms of Tularosa Black-on-white comparable to those of Pinedale and Klageto. With the various earlier, Chacoan, forms are associated small amounts of Wingate Black-on-red, early St. Johns Polychrome, and related types; with the late black-on-white are found a good deal of Klageto Polychrome and other late St. Johns developments.

The Developmental-Early Classic material includes much the same range as the black-on-white from Allantown, largely of the general "Chaco 2" group or horizon. Predominant types are Puerco and Chambers Black-on-white,[25] tempered with ground sherds and sand. Material of Reserve-Cheta-Whipple-Tularosa[26] affiliation occurs, including some typical Tularosa Black-on-white, and Snowflake Black-on-white.[27]

[20] Roberts, 1940, p. 43. [21] *Idem.*

[22] E.g., Morris, 1939, Pl. 199*a;* Martin, 1939, Fig. 134; Roberts, 1929, Pl. 14, three sherds, Pl. 16*c;* also specimen 3/1 from my 1942 excavations in Mancos Canyon, southwestern Colorado (report in preparation).

[23] Weak versions of Morris, 1939, Pl. 199*c*.

[24] Shepard in Morris, 1939; Reed, N. D.

[25] Colton, 1941*b*, pp. 56–59; compare Martin and Willis, 1940, pp. 154–160.

[26] Colton, 1941*b*, pp. 60–64; compare Martin and Willis, 1940, pp. 165–193.

[27] Colton, 1941*b*, pp. 62–63; Martin and Willis, 1940, pp. 259–263 (probably including some Puerco Black-on-white); compare Roberts, 1940, Pl. 13*c*, *d*.

Although the early type known as White Mound Black-on-white[28] is represented, Chaco 1-Kiatuthlanna[29] (eastern Pueblo I) and Red Mesa[30] (Chaco Transitional I-II) seem to be rare. Rare, and presumably intrusive from the Tusayan region to the northwest, are Black Mesa ("Deadmans")[31] and Flagstaff Black-on-white. A few sherds of true Chaco 2 and 3 occur. Sosi, Walnut, and Mancos Black-on-white are represented by one sherd each, all three from the same site.

Interesting and uncommon variants include Chambers (?) Black-on-white with corrugated exterior and Chacoan pottery with the characteristic slip but with Tusayan (Walnut-Flagstaff) designs and Tularosa designs. The virtual absence of the Little Colorado series (Holbrook and Walnut Black-on-white and related forms) is notable.[32]

The late black-on-white of Tularosa affiliation and derivation is largely referable to the description headed Klageto Black-on-white.[33] This type is distinguished from other similar types of the late thirteenth century by its heavy and well polished white to bluish-gray slip, with designs of late Tularosa-late St. Johns style in dense black to red-brown paint (iron). The types described as Pinedale Black-on-white[34] and Wide Ruin Black-on-white[35] are similar. Klageto Black-on-white is found by microscopic examination to be sherd-tempered.

REDWARE

Less abundant and more varied than the grayware and black-on-white, the brown, red, black-on-red, and polychrome pottery is thought to be intrusive rather than locally made.

A sparsely represented group of undecorated brownware includes examples of the following types: Woodruff Brown,[36] four grayish-brown to red sherds; Woodruff Smudged,[37] one dark gray sherd with reddish exterior; Woodruff Red,[38] a bowl rim with both surfaces slipped and lightly polished; Reserve-Winona Smudged,[39] two sherds, from the same site and probably the same vessel, of well polished brownware with black interior,

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[28] Unpublished late Basketmaker type, apparently extending into Pueblo I times, known from further down the Puerco River, and from other areas, such as the Jeddito Valley, probably as trade.

[29] The use of "Kiatuthlanna Black-on-white" for all "Chaco 1" or "eastern Pueblo I" seems undesirable, since the material from the Kiatuthlanna pit houses is distinctive and specialized.

[30] See Roberts, 1940, p. 44, and Brand *et al.*, 1937, p. 167. [31] Colton, 1941*a*.

[32] Mera, 1934, pp. 8, 9, 13; Colton and Hargrave, 1937, pp. 234–240; Roberts, 1940, pp. 42, 47, 48; Colton, 1941*b*, pp. 53–55. [33] Colton and Hargrave, 1937, pp. 242–244.

[34] *Ibid.*, pp. 241–242. [35] *Ibid.*, pp. 249–250.

[36] Mera, 1934, p. 6. These identifications checked and revised by Dr. Mera.

[37] *Ibid.*, pp. 6–7. [38] *Ibid.*, p. 6. [39] Colton, 1941*b*, p. 29.

sand-tempered like the Woodruff derivative Showlow Smudged,[40] but otherwise closer to the Reserve and Winona types.

Black-on-red pottery not converted to polychromy by the addition of white decoration is also infrequent, save for sherds of late St. Johns-Klageto polychrome type chancing to lack the white. True black-on-red types present include: La Plata Black-on-orange,[41] two bowl sherds; Bluff Black-on-red, sherds of one jar; Puerco Black-on-red (if defined, distinguished from Wingate primarily by broadline decoration instead of use of hachure), two sherds of each of two bowls; Wingate Black-on-red,[42] sherds of twelve bowls and two jars, plus two unpainted, slipped and polished red bowl sherds which seem to be undecorated Wingate rather than any recognized plain red type. Of the last two, the core of one is black, that of the other is gray; both are sherd-tempered. They are clearly not Woodruff Red.[43]

The white exterior decoration series begins with Wingate Polychrome,[44] represented by three sherds, one a slightly recurved rim.

Classical or typical St. Johns Polychrome is well represented by balanced solid and hatched designs as in Tularosa Black-on-white, a good red slip, bold white exterior decoration (not thin as in Wingate), and slightly thickened and/or beveled rims. A prominent variation is distinguished by pinkish slip and yellowish core.

Querino Polychrome,[45] a variation on the St. Johns theme with the bowl exteriors slipped with yellowish white and decorated with red stripes, is represented by seven sherds. The similar variant with unslipped exterior, Houck Polychrome,[46] is apparently not present.

Of the Querino Polychrome sherds, five are of typical yellowish-brown, rather soft paste, and two are of hard gray paste like typical Wingate-St. Johns. On one of the latter the exterior slip is white and is similar to that of Holbrook and Walnut Black-on-white, rather than cream-colored like the typical Querino exterior slip of the others. On one rim of the soft-paste group, black interior decoration is lacking; on another, the paint and design of the black interior decoration seem late—i.e., similar to the Klageto style.

The majority of the redware represents a late development of St. Johns Polychrome, or Klageto Polychrome in a broad sense. The trend which this material represents is mentioned by Mera with a reference to this name,[47] and the name Klageto will be used here to include a con-

[40] Mera, 1934, p. 12.
[41] Martin, 1939, pp. 432 ff.; most of the "Pueblo I black-on-red" in Morris, 1939.
[42] Colton and Hargrave, 1937, pp. 118–119; Martin and Willis, 1940, Pls. 89–96.
[43] Mera, 1934, p. 6. [44] *Ibid.*, p. 11.
[45] Colton and Hargrave, 1937, pp. 122–123. [46] Roberts, 1932, pp. 111–112.
[47] Mera, 1934, p. 17.

siderable amount of material which fits precisely neither the specific type description, based on a single sherd, nor the similar type Kintiel Polychrome,[48] but is obviously related to these.

The pottery thus broadly comprehended under the term "Klageto Polychrome" ranges in color from reddish through orange and yellow to gray; has rims of "late" type, thickened, everted, and beveled; and characteristic solid designs. The black paint is often glazed, but no true Heshota-uthla Glaze-Polychrome occurs. The white exterior decoration is sometimes absent. A few of these sherds correspond quite closely to Kintiel Polychrome, and a few to Klageto Polychrome in the strict sense. All are sherd-tempered and heavily slipped (fifty sherds examined under the binocular microscope at 21 diameters).

Of special interest in the polychrome group is the occurrence of jars. Often it has been stated or implied that St. Johns Polychrome occurs only as bowls, and descriptions have been so worded that jars are perhaps excluded by definition. Three jar sherds from Manuelito can hardly be called anything else, however. One is decorated in Wingate style in black glaze paint, with stripes of white paint below the black decoration; another is decorated on the body in Klageto style with slightly glazed black paint, and on the neck with thick white stripes. The third, with only white stripes, is from a small vessel which may have lacked the black decoration but which could, nevertheless, well be included under the heading St. Johns Polychrome rather than being given a separate designation as white-on-red.

CERAMIC PHASES

The earliest and latest horizons in the area can be readily separated. The intermediate material cannot be clearly subdivided on the basis of surface collections alone and must be left together as Late Developmental-Early Classic. The Pueblo I types are readily separable typologically, but no pure sites are known and few sherds are in the collection.

The early horizon is, of course, the Basketmaker III material, an equivalent of the Lino focus.[49] Ceramically, this phase consists of Lino Gray, which is predominant, and "La Plata Black-on-white," which is fairly common, with rare intrusive sherds of Woodruff Brown, Woodruff Smudged, and apparently La Plata Black-on-orange. The sites are sherd areas—presumably pit-house sites—with few surface remains of structures visible except for a few slab cists. There are five known pure sites of this phase, and the horizon is well represented at five sites also showing later occupation.

[48] Colton and Hargrave, 1937, pp. 126–127.

[49] Colton, 1939, p. 53.

The general intermediate group comprises Pueblo II or "III a" black-on-white and corrugated pottery, with a variety of presumably intrusive redware types—Woodruff Red, Reserve-Winona Smudged, Bluff Black-on-red, Puerco Black-on-red, Wingate Black-on-red, Wingate Polychrome, Querino Polychrome, and classical St. Johns Polychrome. There are twenty-one sites recorded in the area which fall in this general ceramic period and were not occupied later, and the period is well represented at five or more of the late-phase sites.

The late horizon, referred to herein as the Kintiel focus, is characterized by Klageto Black-on-white, with variations, and Klageto Polychrome (in the broad sense, including other late St. Johns forms, as Kintiel and St. Johns Glaze-polychrome), with its black-on-orange subtype and minor color variants. The sites of the horizon include large pueblos in defensive locations with small outliers. There are sixteen sites which were occupied in the period—four large, one small but highly defensive, and eleven little pueblos, mostly subsidiary outliers of large ones. Nine of the sites show little or no earlier occupation.

Dating of these periods in the Manuelito area is wholly inferential, as no tree-ring dates are known from any of the sites. The first phase, the Lino focus or Modified Basketmaker period, can reasonably be dated here as elsewhere at between 450 and 750 A.D. The intermediate period can only be assigned the several centuries intervening between Modified Basketmaker and the late horizon; the various pottery types of the period are dated elsewhere at various times from 700 A. D. to after 1200 A.D. The Kintiel focus can safely be dated in the second half of the thirteenth century on the basis of the general characteristics of its pottery and the dates known for its pottery types elsewhere.

The end of occupation of the Manuelito area not very long after 1300 is suggested by the total absence of Heshota-uthla and Four Mile Polychrome, Jeddito Black-on-yellow, Homolovi Polychrome, or other fourteenth century pottery types known from adjacent areas, including the Petrified Forest.[50] Occupation until about 1300, however, is indicated by the general "late" appearance of the Klageto black-on-white and polychrome, and by the frequency of glaze-paint on the polychrome.

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[50] Mera, 1934, pp. 17–21.

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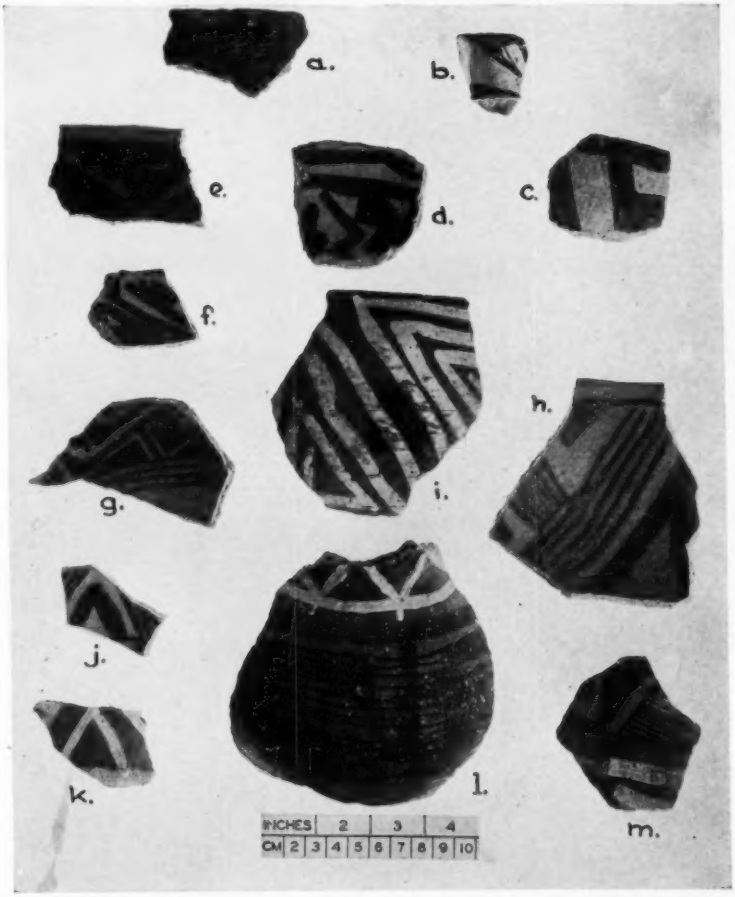
Santa Fe, New Mexico
April, 1943



Redware and modern pottery. *a*, modern Navaho scored utility ware; *b*, Zuñi Polychrome (modern); *c*, Querino Polychrome (12th or 13th century), lacking interior decoration; *d–f*, Klageto Polychrome (1250–1300), *f* with red interior surface; *g–i*, St. Johns Polychrome (red surfaces, exterior decoration in bold stripes), interior decoration of *i* like *g*, plus hatch-filled elements; *j*, Klageto Polychrome, restricted definition; *k–m*, St. Johns Polychrome jar sherds (*k*, no black decoration; *l*, black paint glazed, late style; *m*, black paint glazed).

Photos courtesy of Museum of the American Indian

Negative-painted pottery from Crystal River, Citrus County, Florida. *Upper*, jar, diameter of rim 3¼ inches; *lower*, bowl, diameter of rim 6½ inches.

NEGATIVE-PAINTED POTTERY FROM CRYSTAL RIVER, FLORIDA

GORDON R. WILLEY and PHILIP PHILLIPS

THE occurrence of negative painting on two vessels from Florida raises some interesting questions in regard to the significance of this type of decoration in the Southeast. The vessels were excavated by Clarence B. Moore at Crystal River on the Gulf Coast about eighty miles north of Tampa Bay, and are illustrated in his report of 1903, *Certain Aboriginal Mounds of the Florida Central West Coast.*[1] Brief references in the text describe them as bowls of excellent ware decorated with black pigment which has grown faint with wear and time. Moore, of course, makes no allusion to the technique of negative painting, since its presence in the Southeast was not suspected at the time.

The vessels are now in the Museum of the American Indian, Heye Foundation, through whose courtesy the accompanying photographs are reproduced (Pl. XVI).[2] The first, Moore's vessel No. 13, is a subglobular bowl of hard sand-tempered ware, 11.5 cm. in diameter, with an exteriorly thickened rim terminating in a broad horizontal lip. The base is rounded and there is a "kill" hole broken out at the center. The light cinnamon-buff surface, smoothed to a degree of low polish, bears a faded decoration in the dull black pigment characteristic of negative painting. The simple curvilinear design can be sufficiently made out in the photograph.

The second vessel, Moore's No. 20, bears an unusual combination of negative and direct painting. It is generally similar to its companion in shape and treatment, though slightly larger (19.5 cm.) and without rim modification. The negative-painted decoration is likewise similar, but over it is a totally different rectilinear design in direct painting. A dark maroon-red has been used to form a continuous series of rectangular panels, within which are light red interlocking elements. The unusual feature of this combination lies in the lack of correspondence between the two designs. In all other cases known to the writers where direct painting is applied over negative painting it follows the lines of the original design.[3]

Recognition of the presence of negative-painted pottery in the Southeast is not new. Since the first mention by Max Uhle in 1925,[4] there have been a number of published references, but no detailed description of pottery so decorated nor any adequate discussion of the

[1] Moore, 1903, pp. 388, 391. [2] MAI Cat. Nos. 17/3523, 18/326.

[3] A large fragment of a third negative-painted vessel is illustrated in the 1903 report (Fig. 28, p. 389). However, since we have not had an opportunity to examine this sherd, the discussion in this paper will be confined to the two vessels described above.

[4] Uhle, 1925, p. 679.

technique involved. For the latter we are obliged to turn to the Middle American field, where negative painting has long been known as an important decorative technique. It was first described, and the suggestive term "lost color" applied, by W. H. Holmes in his pioneer work on Chiriquian antiquities published in 1888.[5] His purely theoretical reconstruction of the technique employed was somewhat as follows: a thin black pigment was carried over the area to be decorated, and upon it were traced the designs in a "taking-out" medium, which when removed carried with it the black pigment, exposing the design in the original surface color of the vessel. If this were the correct solution, the term "lost color" would be admirably descriptive. However, a better solution was brought forward by C. V. Hartman, whose attention had been caught by a method of decorating gourds still in use in certain parts of Salvador.[6] In this method the decoration is painted on in melted wax, after which the entire surface is coated with a black pigment. The gourd is then dipped in boiling water, which melts off the wax and with it the overlying pigment, leaving the pattern exposed in the lighter color of the rind. Archaeologists familiar with negative-painted pottery in Middle and South America are in agreement that this, or something very like it, was the technique employed. Thus Lothrop defines negative painting as follows: "As in true batik textiles, all portions of the field of decoration which it was desired *not to color* were blocked out in liquid wax and the vessel was then dyed. When the dye had dried the wax was removed—as well as the pigment covering—and a pattern in the original surface was revealed against the darker background of the dye. . . . Pottery vessels adorned by negative painting can usually be distinguished at a glance, owing to the quality of the decorative lines and the tendency of the patterns to fade in a manner differing from ordinary brush-applied designs. These characteristics cannot be fully set forth in writing or seen in much reduced illustrations, but become apparent from examination of actual specimens."[7]

Unfortunately, the last remarks apply no less in the Southeast. It is impossible to demonstrate objectively that the vessels under consideration here exhibit true negative painting in the Middle American sense. We can only echo Lothrop: examination of the actual specimens, against a background of a certain amount of familiarity with Middle and South American examples, leaves absolutely no room for doubt. Indeed, one

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[5] Holmes, 1888. It is strange that Holmes did not recognize the fact that several vessels illustrated by him in his great treatise on the pottery of the Eastern United States were decorated by negative painting. Cf. Holmes, 1903, Pl. XVII (several examples in the bottom row); Pl. XXII, *c;* Pl. XLV, *lower right;* Pl. L, *top row center;* Pl. LVI, *b;* p. 113, Fig. 56; Pl. CXVIII, *a.* [6] Hartman, 1910. [7] Lothrop, 1936,

of the outstanding characteristics of negative painting, wherever found, is the remarkable uniformity of treatment. This applies particularly to the type of pigment and quality of line, but also, to a surprising degree, to the character of design. In all respects the Crystal River specimens come up to Middle American specifications.

The distribution of negative painting in the Southeast is shown in Figure 11. Only in the Tennessee-Cumberland region, on the lower Ohio, and on the Mississippi below the mouth of the Ohio does it occur in sufficient force to be regarded as an important element in local pottery complexes. In the Tennessee-Cumberland and on the lower Ohio it appears to have been virtually the only type of painted decoration;[8] on the Mississippi, particularly in southeastern Missouri, it competes with direct painting on approximately equal terms, and is often combined with it.[9] It is doubtless significant that further down the Mississippi, in the rich painted-pottery region of eastern Arkansas, negative painting is extremely rare. This diverse, though overlapping, distribution of negative and direct painting suggests separate histories for the two types in the Southeast. Elsewhere, over a remarkably wide area, negative painting occurs only sporadically; most of the outlying locations on the map are, like Crystal River, represented by a very small number of specimens. The Tennessee-Cumberland, therefore, both from the standpoint of quality and central location, appears to be the primary center of diffusion. Here also the chronological relations are best known, so that with very little hesitation we can assign negative painting in what appears to be its homeland to a late Middle Mississippi (Temple Mound II) period. All other known occurrences agree with this dating, except perhaps Crystal River, to which we shall presently return.

As might be expected, over such a wide area stylistic factors are subject to considerable diversity, making summary characterization impossible. At the same time, it is noteworthy that certain shapes and designs are repeated with little change from one end of the area to the

[8] An exception, which rather serves to call attention to the scarcity of direct-painted ware in the Tennessee-Cumberland, is Hiwassee Red on Buff. In this paper, red-slipped ware is not included in the term "painted." Any remarks about the distribution of direct- and negative-painted pottery will exclude plain red ware, which we regard as representing a separate and distinct type of treatment.

[9] In this combination it appears that the design is first laid on in negative painting, after which the unpigmented areas are painted over in red and white, resulting in a three-color ware (red-white-black). Possibly the negative process in this case was conceived merely as a preliminary method of laying out the design, with the advantage that, since the stopping-out medium was removable, mistakes could be readily corrected or the whole design removed and started afresh. This is, of course, entirely different from the combination seen in our second Crystal River specimen, in which the overpainting bears no relation to the negative-painted design beneath it.

FIG. 11.—Distribution of negative-painted pottery in the Southeast.

other.[10] Evidently two counter tendencies are at work. Along with the spread of the technique seem to have gone certain elements of design—possibly in some cases the pots were traded—resulting in a homogeneity easily overemphasized. On the other hand, once lodged in a new area, negative painting seems to have been adapted to current ideas of shape and decoration, resulting in local specializations. Unfortunately, neither tendency is well exhibited in the Crystal River vessels. They are typically Floridian in everything except decoration, so there can be no question of trade, but the designs, while generically Mississippian in the sense that they are made up of elements common throughout the South-

[10] Compare the bottle from the Haley Place on the Red River in southwestern Arkansas (Moore 1912, Pl. XXXVII) with examples from Etowah (Moorehead, 1932, Fig. 33*c*) and Hollywood (Holmes, 1903, Pl. CXVIII, *a*) in Georgia.

east in that horizon, are not specifically related to any negative-painted ware known to the writers. About the most that can be said on the basis of typology alone is that connections between the negative painting of Crystal River and that of the Tennessee-Cumberland are neither strongly indicated nor entirely precluded.

Speculations on typology based on two vessels, were there no other considerations involved, would be futile indeed. In the present case, however, there are other considerations. The Crystal River site, as Greenman has amply demonstrated, has definite, though as yet unex-

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Sources of information relative to occurrence of negative-painted pottery in the Southeast.

Site or Locality	*Source of Information*
Angel	Personal communication, Glenn A. Black.
Bull Creek	Material in possession of Society for Georgia Archaeology, Columbus, Georgia (in 1937).
Crystal River	Moore 1903, figures.
Etowah	Moorehead, 1932, Fig. 33.
Fulton County	Spoon River focus, Cole and Deuel, 1937, Fig. 11.
Glover	Williams site, Webb and Funkhouser, 1929, p. 25, Figs. 35, 36.
Guntersville	"Hardin Negative Painted," personal communication, Marion Dunlevy.
Haley Place	Moore, 1912, Pl. XXXVII.
Hazel Place	Vessel in University of Arkansas Museum.
Hixon	Lewis and Kneberg, 1941, Pl. V, No. 12; 1943, Figs. 6, 7.
Hollywood	Holmes, 1903, Pl. CXVIII, *a*.
Kincaid	Material in Department of Anthropology, University of Chicago.
McCabe	Personal communication, William G. Haag.
MacLeod Bluff	Webb and Funkhouser, 1933 (information by J. B. Griffin).
Mobile	Vicinity of, Holmes, 1903, Fig. 56.
Monnette	Vaillant, 1939, Pl. 28.
Moundville	Moore, 1907, p. 356, Fig. 20 and material in University of Alabama Museum.
Nacoochee	Heye, Hodge and Pepper, 1918, Pl. V.
Nashville District	Numerous sites in Thruston, 1897; Jones, 1876; and collection in Peabody Museum, Harvard University.
New Madrid	Several sites, Evers, 1880, and collections in Peabody Museum, Harvard University, and American Museum of Natural History, New York.
Peachtree Mound	Setzler and Jennings, 1941, Pls. 38, 39.
Pickwick Basin	Site Lu°21, Webb and DeJarnette, 1942, Pl. 63, *l*.
Spendthrift	Material collected by Central Mississippi Valley Archaeological Survey.
Warrior River	Moore, 1902, p. 341.
Wheeler Basin	Site Ma°3, Webb, 1939, Pls. 96–97.

plained, Hopewellian relationships.[11] The possibility, therefore, that divergence in negative painting from Tennessee-Cumberland norms may be the result of a time differential, with the advantage in favor of Crystal River, must be thoroughly examined. This will require a brief review of Florida sequences and an attempt to place the Crystal River finds in their proper chronological setting.

Recent stratigraphic excavations in shell heaps along the northern portion of the Florida Gulf coast have thrown a good deal of light on the previously excavated burial mounds of the region and have provided a tentative ceramic time scale.[12] The earliest period, Deptford, preceded the burial mounds and therefore does not concern us here. Immediately following the Deptford are the Santa Rosa-Swift Creek (early eastern complicated stamped) potteries. Small sand burial mounds are characteristic of this period. Some of the mounds excavated by Moore may be considered Santa Rosa-Swift Creek burial places.[13] All of these lay to the west of the Apalachicola River, some 200 miles by land northwest of Crystal River. East of the Apalachicola the Santa Rosa-Swift Creek complex has not been found.[14]

The small sand burial mound continues to be a characteristic feature during the succeeding Weeden Island period. Indications are that population was relatively dense in Gulf Florida at this time. Some sixty mounds excavated by Moore showed typical Weeden Island pottery, as well as concurrent traits.[15] It appears that the Weeden Island culture is remarkably uniform throughout a 400-mile sweep from Mobile Bay to the Little Manatee River. An inland range of some fifty miles is indicated. Crystal River falls somewhat to the south of the center of this distribution.

Fort Walton in the north and Safety Harbor and Englewood in the Tampa Bay district are names given to a somewhat less homogeneous late period and culture geographically co-extensive with Weeden Island. In the north, flat-topped pyramidal mounds have already made their appearance, one or two examples even dating from the preceding Weeden Island period, whereas in the central and southern portions

[11] Greenman, 1938, p. 331. [12] Willey and Woodbury, 1942.

[13] Moore, 1902. Alligator Bayou (pp. 150–152) and Anderson's Bayou (pp. 160–162) are two examples of mounds showing only pottery of the Santa Rosa-Swift Creek period.

[14] Occasional sherds and vessels of Marksville-like pottery have turned up in other cultural contexts as far south as Tampa Bay (cf. Holmes, 1903, Pl. CVI, *b*, *c*) and as far east as the St. John's River. Swift Creek pottery is found all over north and central Florida. What appears to be a late variant of the type is a marker of the Weeden Island period. The nature of early Swift Creek sites in north peninsular Florida is not known, but scattered finds of the type indicate its presence.

[15] Moore, 1901, 1902, 1903, 1907, 1918.

sand burial mounds continue to hold the field.[16] Pottery types of this late period reflect Middle Mississippi influences, probably by way of Alabama and Georgia. As might be expected, these influences are strongest in the northern part of the state.[17]

Getting back to Crystal River, Moore's collections were taken from a large sand burial mound which, in the course of the two separate visits, he demolished completely.[18] Other features on the site included two pyramidal mounds with ramps and a large shell ridge, probably a midden. These were tested with results that did not lead to complete excavation. All material, therefore, came from the burial mound and henceforth, in discussing the relationships of "Crystal River," reference will be to the mound rather than to the site as a whole.

This mound, about 10 feet high by 70 feet in diameter, was partly surrounded by an irregular addition or annex presumably somewhat later in date, the whole surrounded by a low circular embankment of sand. Moore recorded over 400 burials in the mound and annex, mainly primary interments in various positions, of which the largest number were extended. Grave offerings, including pottery, were placed with individual burials rather than in a common mortuary deposit. Of thirty-seven complete or restorable vessels twenty-six were plain. Decorated vessels included, besides the negative-painted bowls already described, Wakulla Check Stamped,[19] Crystal River Incised,[20] and an incised and red-painted, or zoned type.[21] Sherds scattered through the sand fill of the mound included various Weeden Island types,[22] Marksville-like rocker-

[16] Cf. Moore, 1901, pp. 435–454. Fort Walton is the type site for the late period in northwestern Florida. The Englewood and Safety Harbor complexes are known from a study of notes and materials in the National Museum, Washington, D. C.

Examples of pyramidal mounds in the Weeden Island period are the Hall Mound and Mound Field (Moore, 1902, pp. 306, 383). Both are described as circular in plan, but their flat tops and ramps indicate an original pyramidal type. It is well known that small pyramidal mounds tend to become circular in outline as a result of weathering.

[17] Across the peninsula, on the St. John's River, is another archaeological area, or sub-area, distinct from the west, at least during the three later periods of Gulf coast development. These burial mound sites, such as Broward, Shields, Grant, Thursby, etc. (Moore, 1894, 1896) may represent more than one horizon, but they all have a good deal in common as opposed to the western side of the peninsula. This St. John's mortuary complex is mainly composed of plain pottery of unusual shapes and curious clay effigies. A few sherds of Weeden Island and Swift Creek types appear and, rarely, a vessel suggesting Hopewellian. Copper and stone work, however, provide the best links with the latter. It is suggested here that the Hopewellian influence in these sites is the same as that seen at Crystal River, and that it derives from a different origin than the Marksville traits of the Santa Rosa-Swift Creek complex in the west.

[18] Moore, 1903, pp. 379–413; 1907, pp. 407–425.

[19] Moore, 1903, Fig. 34.

[20] Moore, 1903, Figs. 21, 35; 1907, Fig. 9.

[21] Moore, 1903, Fig. 24.

[22] Moore, 1907, Fig. 2 (two top sherds and left-hand sherd in third row).

stamped,[23] simple stamped,[24] cord-marked,[25] and two fragments with realistic (hand and bird) engraved designs.[26] Plummets of shell, stone, quartz crystal, and copper were found in profusion. Also of copper were a number of bicymbal ear-spools (several plated with silver and one possibly with meteoric iron), conjoined tubes, and flat pieces with simple repoussé decoration. Shell cups, ornaments, and sheet mica were plentiful, and there were pipes, both stone and pottery, in elbow and monitor forms.

Before discussing the probable date of this material, it will be well to dispose of the possibility that two distinct periods are represented by the mound and its annex. That the annex is of later construction is clear from Moore's account[27]—but how much later? In his report on the first season's work, when both mound and annex were dug extensively, there is no segregation of material. Fortunately, the later excavations were in the annex only. Comparison of this later material with the earlier shows the same types of artifacts throughout, the only difference being, as Moore points out in both reports, the superior quality and abundance of artifacts in the mound. One can agree with his conclusion that the annex represents a slightly later date and a burial place of a meaner sort.[28] However, the important fact is that most of the pottery, including the negative-painted bowls, came from the mound, along with the "superior" objects of stone, copper and shell.[29] This also disposes of the troublesome possibilities of intrusive burials. Moore speaks of the crowded conditions, graves cutting through other graves, etc., but only in the annex. Such conditions were evidently not observed in the mound. It appears, therefore, that we are justified in assuming that the Hopewellian traits and the mortuary pottery, not excluding the negative-painted bowls, were in undisturbed association, that for purposes of this discussion the material represents a single period of comparatively short duration. It is possible to date this period with reasonable accuracy in terms of the Florida sequence.

[23] *Ibid.*, Fig. 2 (right-hand sherd in third row).

[24] *Ibid.*, Fig. 2 (right-hand sherd in bottom row).

[25] Moore, 1903, Fig. 20 (top left). [26] *Ibid.*, Fig. 18; Moore, 1907, Fig. 3.

[27] The mound was of sand, whereas the annex contained a considerable admixture of shell; consequently it was possible for Moore to determine that the annex abutted on the mound clear to the base. [28] Moore, 1907, p. 425.

[29] Cf. Moore, 1903, p. 383. "Artifacts were very numerous in the mound and in the elevation, those from the mound proper were of much higher grade, as a rule, than were the artifacts from the sloping mound around it. . . . Outside the mound but few vessels were met with." Since the negative-painted bowls were among the outstanding vessels, it seems safe to assume that Moore would have mentioned them as exceptions to the statements just quoted, had they been taken from the annex rather than from the mound.

Most of the vessel shapes are characteristic of the Weeden Island period. This applies to the negative-painted bowls, though, as we have already observed, their decoration is not Weeden Island, nor does it correspond to any other West Florida style. Flattened globular bowls,[30] bi-globular jars,[31] collared jars,[32] and lobed jars[33] are common Weeden Island forms. The other shapes illustrated by Moore are occasionally seen in association with Weeden Island pottery but cannot be considered typical. Check-stamped pottery of the small grid variety, i.e. Wakulla Check Stamped, reaches its maximum in late Weeden Island times, though it has been known to occur occasionally in earlier contexts.[34] The Crystal River Incised vessels are reminiscent of both Weeden Island and Fort Walton, favoring the first in shape and the second in decoration. Similar vessels of this type have been found at other sites in association with Weeden Island types.[35] Only the unusual number of tetrapodal supports suggests the earlier Santa Rosa-Swift Creek period. Otherwise the burial pottery taken as a whole—we have given our reasons above for taking it as a whole—appears to be late Weeden Island in date. The incidental sherds in the mound fill do not conflict with this assumption. Earlier types are present, to be sure, but these may be discounted by the possibility that sand used in building the mound was scraped up from an earlier portion of the site. No doubt the site has a longer history than the mound, both earlier and later, but—it may be well to emphasize again—it is with the mound alone that we are concerned.[36]

Among the non-ceramic materials are many specific Hopewellian traits, as Greenman has pointed out. These also occur in Santa Rosa-Swift Creek sites and in pure Weeden Island sites, but in no such abundance as here. The inference is possible that trade contacts were more vigorous at this time than in the earlier periods. It would seem that long after the peak of development in the Ohio Valley, Hopewellian objects were passing from hand to hand—and doubtless being imitated—in ever-widening circles. Only by means of some such rationalization as this can we reconcile the Hopewellian material with a late Weeden Island date.[37] The only alternative is to postulate a stratification within the mound for which there is no evidence in the report.

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[30] Moore, 1903, Figs. 21, 27, 30, 31; 1907, Fig. 9. [31] Moore, 1907, Fig. 8.
[32] Moore, 1903, Figs. 26, 35. [33] *Ibid.*, Fig. 32. [34] *Ibid.*, Fig. 34.
[35] *Ibid.*, Aspalaga Mound, Fig. 148.

[36] For example, the presence of pyramidal mounds this far south on the Florida Gulf Coast no doubt indicates a late period, but this cannot be used as an argument in the present discussion.

[37] A comparable situation may be seen at the Gahagan site in northwestern Louisiana or the Spiro site in eastern Oklahoma, though in both cases the Hopewellian traits are more attenuated than at Crystal River. See Webb and Dodd, 1939.

We cannot claim to have proved that our negative-painted bowls were deposited in the Crystal River mound in late Weeden Island times, but it is a reasonable working assumption on which we can proceed to discuss relationships with the Tennessee-Cumberland culture to the north. The approximate equation of Tennessee-Cumberland with Fort Walton can be established through Etowah, where Tennessee-Cumberland material, including negative painting, was associated with Lamar, which in turn equates with Fort Walton. A similar triangulation could be effected through Moundville and other sites in central Alabama. Our late Weeden Island date for the Crystal River mound is therefore a little early for Tennessee-Cumberland connections. Unfortunately it is not sufficiently early for any positive conclusions. The present state of Southeastern chronology does not permit such fine shading. We have already discussed typological differences, which also were judged insufficient for any positive conclusions. If, then, we must admit that a connection is possible, we are more or less forced by the known facts of distribution to admit also that the derivation of negative painting at Crystal River from the Tennessee-Cumberland is more likely than the other way about. However, it must be obvious that speculations of this nature are entirely premature.[38]

Moreover, there is another aspect of the problem not yet touched upon, to wit, the possibility that negative painting on pottery may have been in some cases the result of a transference of the technique from a a perishable material such as textiles or gourds. The idea is not as fantastic as may appear at first sight. Textile fragments recovered at Etowah were quite evidently decorated by this method.[39] It may even have been in use as early as Hopewellian times; fragments from the Seip Mound should be re-examined with this possibility in mind.[40] Transfer-

[38] We have carefully attempted to forestall the inevitable objection that the negative-painted bowls were intrusive in the Crystal River mound. It may be well to point out in this connection that at Warrior River, 100 miles to the north, Moore found what is almost certainly negative-painted pottery in a pure Weeden Island burial mound (cf. Moore, 1902, p. 341). He describes it as follows: "Considerable parts of a bowl of yellow ware, in fragments, having as decoration lines, triangles and circular markings, all in black pgment." If this is not negative painting it must be a type of painted ware hitherto undescribed in the Southeast.

[39] Moorehead, 1932, p. 64, Fig. 34. In these fragments of cloth, preserved by contact with copper, the designs are in the natural color of the fabric against a background of dark red. The designs, consisting of the cross and the cross within concentric circles, are among the most common motives of Tennessee-Cumberland negative painting. In a manuscript in possession of J. B. Griffin, Ann Arbor, Michigan, Willoughby states that these, as well as other textile fragments from Spiro, Oklahoma, were decorated by the "lost color" process.

[40] Shetrone and Greenman, 1931, Figs. 65, 66. The possibility that negative painting may have been an outgrowth of the negative patterning resulting from background

ence of the technique from textiles to pottery would seem to involve no great technical difficulty, from gourds still less. It is, in fact, not impossible to conceive of such a transference as taking place more than once. The point is raised here, not in order to escape the logic of the evidence as to the relationship between Crystal River and the Tennessee-Cumberland, but rather to point out that the problem has wider bearings. It may become necessary to consider the spread of negative painting as that of a technical process not confined to pottery.

The idea of transference from a perishable material has very definite theoretical attractions. It would account for the seemingly anomalous fact that, in the Southeast, negative-painted pottery appears with explosive suddenness without any apparent earlier stages. Still better, it might furnish a mechanism for getting negative painting in from Middle or South America, otherwise a difficult business, as a glance at the overall New World distribution will show.

Negative painting has a remarkably wide distribution, from southern Peru to the southeastern United States, with apparent breaks of continuity in (1) western Panama, Costa Rica and Nicaragua; (2) southern Mexico; and (3) northeastern Mexico, the Texas Coast, and the lower Mississippi Valley.[41] Ekholm has recently found it near Tampico, stratigraphically dated as late Teotihuacan.[42] This is the nearest occurrence, from the standpoint of both space and time, to the Southeast. It avoids the Southwest completely, so that theories of derivation via that area, often invoked for Mexican traits in the Southeast, cannot be applied in this case.[43] It may also be well to mention that, although negative painting occurs sporadically on the Amazon, it has not been reported from the Antilles.[44] If negative painting in the Southeast is to be regarded as historically connected with the main distribution to the south—and to the writers this seems far preferable to any theory of independent invention—it is to northeastern Mexico that we must turn for its most probable immediate origin. This, however, is a question beyond the scope of the present paper.

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roughening, as in Hopewell and Marksville pottery, must be kept in mind. A similar negative technique is even more fully developed in Hopewellian bone engraving. In short, the marked tendency to produce designs by negative means in Hopewellian art generally suggests that negative painting may have been present in, or in some way connected with, the Hopewellian culture. Its variance in distribution from direct painting and other pronounced Mississippian traits might possibly be explained on this basis.

[41] Lothrop, 1936, pp. 8–13; Linné, 1934, pp. 162–167.

[42] Personal communication.

[43] The negative patterning in Chihuahua pottery, often cited in this connection, does not involve a true negative painting technique.

[44] Irving Rouse, personal communication, March, 1943.

So far as negative painting at Crystal River is concerned, we are able to conclude only that its significant relationships cannot be appraised in the light of our present limited knowledge of the subject. A connection with the Tennessee-Cumberland is certainly indicated, but the nature of that connection requires careful consideration of more evidence than is at present available. The discussion has, we hope, suggested that the subject has wider and possibly earlier ramifications than is generally supposed, wider in the sense that the technique seems not to have been confined to pottery, earlier in the sense of possible involvement in the conspicuously negative decorative tradition of the Hopewellians. This possibility is high-lighted at Crystal River by the association of negative painting and specific Hopewellian elements.

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Harvard University
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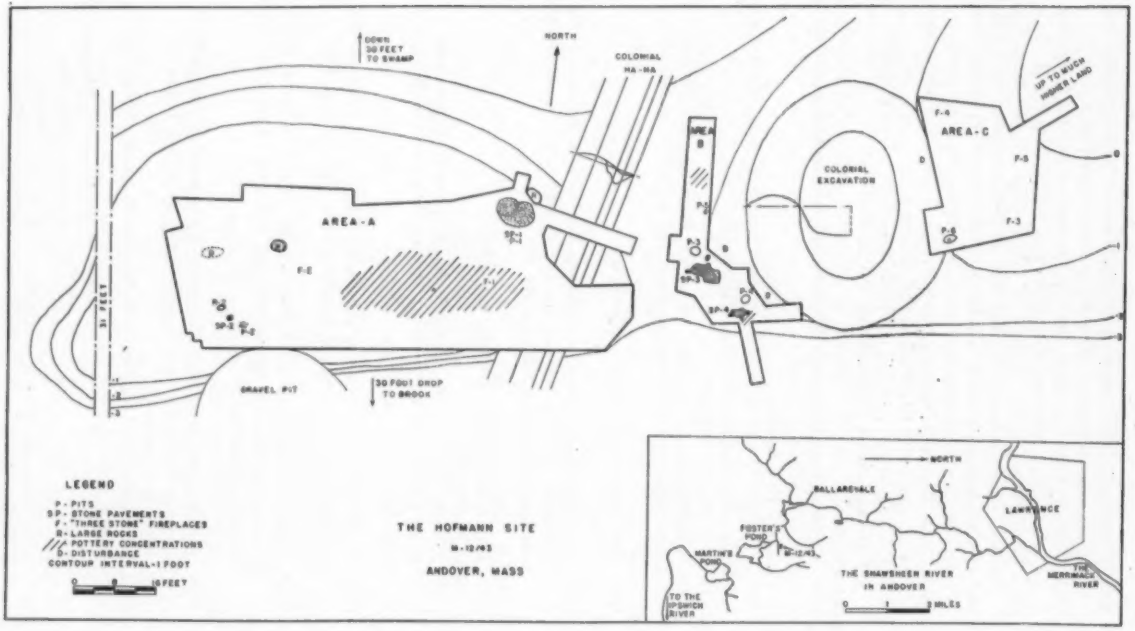


FIG. 12.—Plan of the Hofmann site and excavations, Andover, Mass.

THE HOFMANN SITE

RIPLEY P. BULLEN and ARTHUR M. HOFMANN

THE Hofmann site is in the Ballardvale section of Andover, Massachusetts. It covers the top of a small kame extending, between a small brook and a swamp, from higher land to the northeast (Fig. 12). This brook empties into a larger stream connecting Foster's Pond and the Shawsheen River. A large swamp, between Foster's and Martin's Ponds, connects these tributaries of the Shawsheen and Ipswich Rivers, forming an inland all-water route from the Merrimack River to the clam-bearing coastal flats of Ipswich and Essex. The Saugus or Mystic Rivers may be reached by a short portage, bringing Boston Bay into the system. The Hofmann site is well located to take advantage of such a route, and the association of artifacts found there seems most easily explained on the basis of trade or the seasonal migration of a few families.

The site was first discovered in 1895 when the co-author's father, the late Emil K. Hofmann, while hunting, noticed chips in the dirt thrown out from what he considered to be an abandoned wood-chopper's cellar hole (Colonial Excavation, Fig. 12). In 1912 Warren K. Moorehead, while investigating the trench (Colonial Ha-Ha, Fig. 12) which crosses the site, rediscovered the hole and dug extensively in and around it and also did some test-pitting in the site. Moorehead considered both the hole and the trench, which extends some 4000 feet, to be Indian in origin,[1] but the authors, finding the old sod line under the thrown-out dirt, the usual site profile below, inverted stratigraphy above, and clods in the bottom of the thrown-out dirt, concluded they were both of Colonial origin.[2]

The excavations covered by this report were made during the summers of 1939 through 1942, the first three seasons by Hofmann alone and the last one by both authors. As shown on the map, Fig. 12, three areas, A, B, and C, were excavated, as well as some tests which are not indicated. Area B, entirely dug during the 1942 season, proved to be relatively the richest, while the slight dip between it and Area A, through which the ha-ha ran, was the poorest. It would appear that the richest part of the site may have been that between Areas B and C, all of which was disturbed by Moorehead. He mentions points, knives, and "upwards of a half bushel of flakes," and his illustrations show types that are the same as those found by the authors.[3] There is no reason, therefore, to feel that the situation in this disturbed portion may have been any different from that found consistently in the more than 4000 square

[1] Moorehead, 1912. [2] Bullen, 1942. [3] Moorehead, 1912.

feet carefully excavated. With the exception of lumbering activities and Moorehead's work, the site had not been disturbed or plowed prior to excavation.

The normal site profile consisted of three layers: first, 2½ inches of sod over about 3 inches of dark brown humus-stained sand, sometimes containing charcoal; second, a sandy layer of variable thickness, blending from red-brown at the top to yellow-brown at the bottom and resting unconformably upon the zone below; third, sterile yellow or white sands and gravels of glacial origin.

The red-brown portion of the second layer was the main occupational level. Near the middle of the site it was about 5 inches thick and blended into the yellow-brown, which varied in thickness from 3 to 7 inches. Off the site these layers were similar, but the color range was from a light brown to the yellow-brown. Towards the northeast these sands were thicker, presumedly from slope creep, while to the southwest they ran out, leaving scanty grass growing directly on the gravel. In the latter case, chips and artifacts were found in the upper part of the gravel.

The structural features consisted of pits, "three-stone" fireplaces, and stone pavements, located as shown on the map, Fig. 12. The pits, which varied from 6 to 30 inches in diameter and from 9 to 26 inches in depth, contained no clues as to their use. Pit 2, containing a quartz chip and core, had stones 4 inches in diameter along one-third of its circumference. Pits 2 and 5, and possibly 1, which was under Pavement 1, started in the red-brown layer, but the others, as far as could be ascertained, commenced at the division between the humic and red-brown layers. There was a tendency for artifacts to cluster around the pits. This was particularly true of Pit 3, around which there were eleven artifacts within a three-foot circle and at a depth of from 3 to 6 inches below the top of the red-brown layer.

The "three-stone" fireplaces consisted of three medium-sized stones, with charcoal in between, and arranged as three sides of a hollow square. One of them had a post hole on either side.

Stone Pavements 3 and 4 may indicate dwelling units, but there were no accompanying post holes. They were level and made of small angular fragments of rocks packed closely together. They were partly one and partly two courses thick. Artifacts were found in and under them, but not in the form of caches. Pavement 3 contained some charcoal and had a reddened area, toward Pit 3, but this was not true of Pavements 2 and 4. Angular fragments of rocks, frequently fire-reddened, were also found scattered over the site, but they were not packed into pavements.

Pavement 1,[4] containing only one round stone, was built of larger

[4] Hofmann, 1942.

angular fragments, from 3 to 12 inches in size, placed close together with the flattest side up. It was probably built in two stages, as the west portion is higher. This additional height was the result of the presence of more sand underneath, not of the use of an extra layer of rocks. Both portions were saucer-shaped, with a 4 to 5 inch concavity, the larger rocks being at the perimeter. Overall, it measured 7 feet 10 inches by 6 feet 3 inches While the other pavements were completely in the red-brown layer, this one began just under the grass-roots. There was, however, no humic layer under the rocks, but there was a half-inch layer of charcoal which thickened to 2 inches at the middle, between the two portions of the pavement. Apparently the surface underneath had been especially prepared and the charcoal sifted through between the rocks.

Unlike the other pavements, this one had no chips or artifacts associated, although one chip was found underneath it. The top of the pavement (or hearth) seems to have been kept fairly clean. To the east, under the thrown-out dirt from the ha-ha and in and under the old sod line, was a very large accumulation of charcoal and ash, together with calcined bone. While no pit walls could be found, there seems to have been a considerable amount of aboriginal disturbance at that point. Many angular rock fragments were found extending down into the yellow-brown sand. These may represent debris from the reconstruction of pavement 1.

Except for the evidences of fire, there were no definite clues to the use of this pavement. There were no chips in the ground for several feet around it. The eight specialized spear points (Pl. XVII, *i–k*), all broken, possibly ceremonially, were found scattered in a ten-foot circle about halfway between this pavement and the "three-stone" fireplace (F-1 in Fig. 12). Possible uses for this pavement or hearth include firing pottery, sweat baths, shamanistic ceremonies, and barbecues.

A pit, 16 inches in diameter and 15 inches deep, was found a short distance in from the southeast edge of the pavement. It contained a little charcoal, two rock fragments, what may be birch-bark remnants, and sand. The latter was stratified in three layers, light brown, dark brown, and gray, from top to bottom.

Tabulations of the stone artifacts and pottery accompany this report, and type specimens are illustrated in Plate XVII. No worked bone was found.

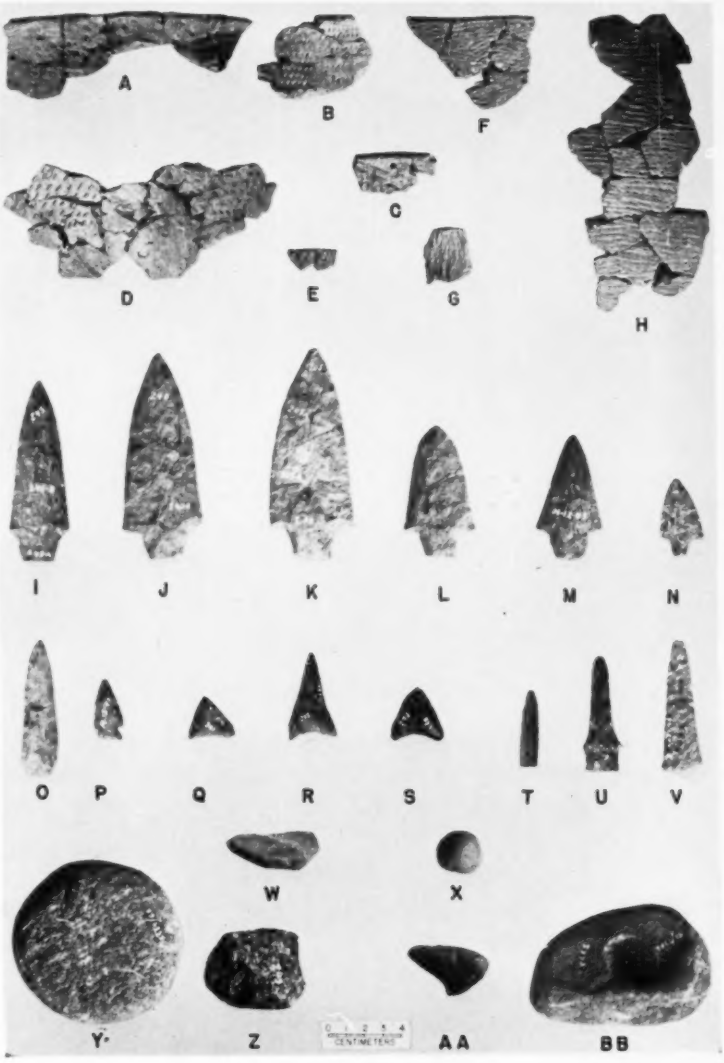
The arbitrary division between arrow and spear points was set at 2½ inches (65 mm). In addition to what may be a knife (Pl. XVII, *o*) and the two small side-notched points (Pl. XVII, *p*), the points include sixteen stemless triangular and twenty-seven stemmed arrow points and thirty-two stemmed spear points. While the stemmed points vary in

STONE ARTIFACTS

Type	Plate XVII	Quantity	Length (in mm.)	Comments
Triangular points	*q*	3	23	Bases, one straight, two concave
	s	10	28–40	Bases, two straight, eight deeply concave
	r	3	47	Bases, concave
Specialized spear points	*i*	1	95	Very well made, except for *i*, extremely uniform, 40 to 50
	j	5	105 to	mm. wide, 7 to 8 mm. thick, stem angle approaches
	k	2	110	90°, some barbs droop
Other spear points	*l*	2	70–75	Probably a reworked *k*
	m	18	65–97	Straight sides, heavy, bases similar to *j*
	—	4	65–75	Narrow points, modified *m* base
Arrow points	*n*	27	35–64	Two (plus two tips) carefully made and only 6 mm. thick, balance rather heavy
	p	2	33	One corner missing
Drills	*t*	1	?	Neatly chipped, black felsite, not *in situ*
	u	5	63	Three more tips appear to be of this type
	v	1	75	Extreme tip missing
Knives	*o*	1	75	Possibly a spear or lance point
	w	4	50	Merely chips with retouched edges
	—	2	50	Top convex, bottom concave
Scrapers	*x*	1	50	Disc type
	—	1	20	Somewhat dubious, snub-nosed type
Pestle	—	1	—	Fragmentary, pecked, rounded end, not *in situ*
Muller	*y*	1	80	Fine granite, possibly a hammerstone
Graphite	*aa*	1	—	Worn concave, much scored
Stone ball	*z*	2	20–40	
Rounded pebbles	—	7	28–70	One used as a hammer
	—	1	110	One side polished, adjoining edge ridged as if used as sinew stone, one end and side pecked
Cupped stone	*bb*	1	90	Cup, 22 mm. diam., 5 mm. deep on smooth top, bottom rough but evidence of pecking
Anvil stones		Several		Left as used, slightly hammered surface up, chips and possible chipping hammer nearby

workmanship, they are all inclined to be large, heavy, and extremely consistent in shape. The angle between the stem and blade approaches a right angle and the barbs may or may not droop. The triangular points are less consistent. The specialized spear points, while having slightly variant blades, have identical bases.

It will be remembered that the site consisted essentially of a humic layer over a red-brown sandy layer. The triangular points were all found in the humic layer or in association with the dividing line between that layer and the red-brown. The stemmed points were only found in



Specimens from the Hofmann site.

the red-brown (or yellow-brown) layer.[5] In spite of this apparently perfect stratigraphy, the material was the same and duplicate chips were found in both layers.[6]

With the exception of the pestle fragments and one of the drills (Pl. XVII, *i*),[7] the stone artifacts were associated with the stemmed points in the red-brown layer.

Except for two points of quartzite and a half dozen possible chips of quartz, all the chipped stone, both artifacts and flakes, were of various felsites. This material is not native to Andover and probably came from the felsite beds near Boston. The very large quantity of chips and the presence of anvil stones suggest a workshop. The graphite also is an importation. Andover granite was used for the pavements, "three-stone" fireplaces, and anvil stones.

Of the fiber-tempered pottery, that with pseudo-basketry decoration (Pl. XVII, *c*) was chiefly found below the grass roots in Area A, while that decorated by means of a cord-wound stick (Pl. XVII, *a*, *d*) came from just southeast of Pavement 4 in Area B. It was from ½ to 3 inches below the division between the humic and red-brown layers. The thick, cord-marked, mineral-tempered pottery (Pl. XVII, *h*) was found in Area B north of Pit 5. It was in the red-brown layer, 1 to 3 inches below the bottom of the humic layer. A small amount of pottery was also found thinly scattered over Area C.

The fiber-tempered ware, in fracturing, produces a great number of plane surfaces and small slits. These plane surfaces also show up as small craters with undercut edges on the surfaces of the pottery. In the majority of cases, striations cannot be seen with an eight-power glass, but all sherds examined with a twenty-four-power microscope showed striations. These could not have been caused by mineral temper, and it seems certain they are all the result of grass tempering.[8] The count shown in the pottery tabulation was made with the eight-power glass. If it had been made with the twenty-four-power microscope it would have been many times more.

Judging from the reconstructed fiber-tempered pieces (Pl. XVII, *a*, *b*, *d*) and from observation of 160 sherds of the pseudo-basketry-deco-

[5] Occasionally chips and artifacts were found near the bottom of the yellow-brown sand.

[6] Chips and artifacts increase and then decrease in frequency, with a maximum halfway through the red-brown. In this connection, it is interesting to note that the site had never been plowed.

[7] Both found in association with the disturbed area near the west end of the site, presumedly a test hole made by Moorehead.

[8] Samples were sent to Mr. Hugh Raup, of the Arnold Arboretum, who kindly identified them as molds of grass.

rated vessel (Pl. XVII, *c*) *in situ*, these vessels were about 20 cm. in diameter and 25 cm. high, with pointed bottoms, slightly restricted necks, and slightly everted rims. The larger rim illustrated (Pl. XVII, *a*) was made by folding back the clay from the outside into the inside and pressing the lap together. The inside had been prepared for this operation by beveling outward at an angle of about 45 degrees from the vertical. The marks left by the beveling tool were plainly visible.

The eighteen assembled mineral-tempered sherds (Pl. XVII, *h*) indicate a vessel about 20 cm. in diameter with gently curving sides and no neck.

Coils 1½ to 2 cm. wide were used in making both the fiber- and mineral-tempered vessels. In at least one instance of the mineral-tempered ware a fillet of clay was added on the inside to fill up a joint.

While 83 per cent of the sherds are fiber-tempered, about ten vessels are represented, six fiber- and four mineral-tempered, some by only one or two sherds. It is likely, therefore, that the popularity of the fiber-tempered ware was not as great as might be inferred from the sherd count.

DISCUSSION AND CONCLUSIONS

Judging from surface collections, the associations at the Hofmann Site are not those we have been led to expect in Massachusetts. The absence of very small points and the relatively large number of spear points is unusual. In spite of the abundance of pottery, not a single suggestion of polished stone was found. While quartz is available in the neighborhood and is common on nearby sites, only a half-dozen quartz chips were found. With the exception of two quartzite points, the chipped materials were felsites not native to the immediate region. They appear, however, to be from the Wakefield or other felsite quarries just north of Boston.

The corner-removed points, so characteristic of the Hofmann Site,[9] seem to have their roots to the south. While one diagnostic hardly suffices for suggesting a connection, it should be mentioned that the points are, typologically, extremely close to those from Stalling's Island[10] and are identical with many from the shell heaps of the Tennessee River, particularly site Lu° 5 and the upper levels of site Lu° 25, Unit 1.[11] The closest comparable site in the literature appears to be the Koens-Crispin site in New Jersey. In both cases stemmed points predominate, triangular points are not deep, spear and arrow points occur in almost equal numbers, and cord-marked pottery is present.[12]

[9] For another occurrence of these large corner-removed points, reported since this article was prepared, see Hofmann, 1943. [10] Claflin, 1931.

[11] Webb and De Jarnette, 1942. [12] Cross, 1941.

The pottery decoration appears to be closest to that found in the top level at the Lamoka Lake site in New York.[13] Except for the fact that cord-marking was used on pottery, the connection, if any, with the Brewerton focus of the Laurentian aspect would appear to be tenuous.[14]

As mentioned earlier, the pottery was found in various concentrations at about the same level in the upper part of the red-brown or in the lower part of the humic layers. With only horizontal stratigraphy, the only possible assumption is that all the pottery is approximately contemporaneous. The vertical stratigraphy indicates that the introduction of pottery was relatively late in the history of the site.

This brings up the question of relative age. It must be borne in mind that this pottery is by no means crude, even though the use of fiber tempering suggests relatively great age because of its presence in the older horizons of the Southeast. The pottery complex here may be considered simple only in comparison with the form and decoration of known recent manifestations. It is not simple, actually, when considered by itself. The authors feel that it may tentatively be considered early but not extremely old. The heavy stemmed points also suggest a relatively early, atlatl-using period.

The finding of fiber-tempered pottery is not surprising, as Byers suggested its presence in 1937[15] and a few cases of grass molds have been reported from Martha's Vineyard[16] and Maine.[17] Local collections were examined for fiber-tempered pottery. One sherd from Lowell, with string- or cord-wound stick decoration, contained eight grass molds. Of 300 sherds from the Fort Hill site, also near Lowell, six were fiber-tempered. The decoration of the rest was much more complicated than that of sherds from the Hofmann site. The thick, clay-colored, mineral-tempered pottery with coarse dull textile markings (next to the last group in the tabulation) was also found at the Fort Hill site, as well as at the Vesper Country Club site, just north of Lowell.[18]

The presence of fiber-tempered pottery in the middle Merrimack Valley is clearly indicated. There also seems to be a tenuous connection between these sites that might well repay future work.

As mentioned before, the triangular points are associated with the humic layer, while the stemmed points go with the lower or red-brown layer. However, the material is the same. Chips of the same material, while concentrating in the red-brown, are also found in the humus.

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[13] Ritchie, 1932, pp. 111–112. [14] Ritchie, 1940.

[15] Byers, 1937, p. 76. [16] Byers and Johnson, 1940, p. 56.

[17] Hadlock, 1939, p. 20.

[18] The authors wish to thank Mr. J. L. Burtt of Lowell for kindly permitting the examination of pottery from these sites.

ANALYSIS

Plate XVII	Number of Sherds	Number of Casts*			Mineral Inclusions			Color‡	
		Grass	Leaves	Seeds, Twigs, etc.	Percentage†	Size (mm.)	Material	Outside	Inside
									Fiber Tem-
a,b,d	556	48§	31‖	6	1–5	85% less than 0.5 mm.	Rounded quartz	Sayal brown	Sayal brown¶
c	440	242	6	9	1–3	70% less than 0.5 mm.	Rounded quartz plus a little crushed granite	Sayal brown	Sayal brown
e	2	—	—	—	—	—	—	—	—
—	2	—	—	—	—	—	—	—	—
—	1	—	—	—	—	—	—	—	—
									Mineral Tem-
f	50	1	—	—	20–25	2–3 aver.	Angular quartz and granite	Cinnamon	Hair brown
h	40	—	—	—	10–20	2–3 aver.	Angular quartz, granite, and mica	Pecan brown	Wood brown
g	2	—	—	—	25	2–3 aver.	—	—	—
—	54	—	—	—	25	2–3 aver.	Angular quartz and granite	Sayal brown	Avellaneous
—	6	—	—	—	—	—	Angular quartz, granite, and mica	Clay	Clay
—	1	—	—	—	—	—	—	—	—

* Using eight-power glass only.
† Percentage by volume, estimated.
‡ According to Ridgeway.
§ Maximum width, 5 mm., maximum length, 24 mm.
‖ Fern, largest 15 × 8 mm., usually 5 × 3 mm.
¶ Part of inside surface greenish olive-buff.
⇔ Except for these and the following group, all sherds have well-scraped inner surfaces.

OF POTTERY

Hardness (Moh's Scale)	*Thickness (mm.)*	*Rims*	*Decoration*
pered Ware			
2–3	4–8	Everted, top flat, 1 cm. wide (twice neck), slopes slightly outward, decorated similar to neck. Lip plain	*b*, neck, parallel rows of parallel marks 3 ×1.5 mm., spacing between rows increasing from top downward. Rim, transverse row, similar marks. Carved die probable tool. *a*, *d*, neck and shoulder, parallel rows of parallel marks 3 ×1 mm., applied in panels 4.5 cm. wide. Marks slope to right or left by alternate panels. Twisted cord wound on stick probable tool
2–3	4–9 (mode, 6)	Slightly everted, top slightly convex 1.5 cm. wide pinched outward at lip or Top flat, no protrusion, outside lip right angle, inside lip rounded	Outside furrowed to give pseudo-basketry effect. Furrows indicate two different tools used or Outside scraped smooth
—	—	Top flat and plain	Parallel double rows of fine textile imprints
—	—	—	Parallel rows of fingernail impressions
—	—	—	Parallel rows of pseudo-fingernail marks "picked out" of surface by chisel-like tool
pered Ware			
3–4	7–8	Only a suggestion of a neck, rim rounded and pinched on out side.	Both inside and out, small textile(?) marks—5 to the cm.—applied by paddle
3–4	8–12	No neck, rim formed by pinching top 30° toward center of vessel	Both inside and out, cord (or fabric) marks—3 to the cm.—applied by paddle. Horizontal except on slanting rim, where they are vertical
2–3	6–7	Slight flare, convex edge grooved radially	Outside, vertical textile or cord impressions. Inside, hand smoothed; shrinkage cracks on both surfaces**
2–3	7–9	Probably basal portion of *g*	Outside, rough to smooth; inside, indistinct smoothing lines "muddy" or "puddled" in appearance, many shrinkage cracks
2–3	8–13	—	Both inside and out, dull twilled textile imprints, 3 to the cm.
—	—	—	Three parallel lines, 8 mm. apart, incised over dull textile imprint. Width of lines 0.5 mm.

Pottery in some places is completely in the red-brown, in others in the humus, and sometimes at the division.

Hypotheses to fit these facts include two occupations, trade, and a migratory seasonal round of life. One possibility would be shell fishing on the shore in the summer, ascending the Ipswich, Saugus, or Mystic River in the fall, bringing felsite as material for implements for winter hunting. A few charred nuts suggest occupation of the site in the fall. While much calcined bone was found, only a few deer bones were identifiable.[19] Winter hunting, manufacturing, and possibly ceremonial life are suggested. With spring, the run of fish up the rivers would tempt the inhabitants away again.

This hypothesis would explain the lack of heavy implements. Axes, etc., would probably be taken along when the owner left. An equally good case could be made for trade, with raw materials and then finished products moving north along the waterways, and pottery moving south from the larger centers of the Merrimack Valley. As the site is not large and does not yield large quantities of artifacts, its use by a few families as a winter home is logical and fits in with what ethnological material is available.

Apparently fairly late in the history of the site, pottery was introduced and triangular points replaced stemmed points. It is possible that the division between the red-brown and humic layers represents a hiatus, with a second occupation using only triangular points. If it were not for the equivocal pottery, two occupations would be clear. As it is, a transition, resulting from diffusion during the seasonal round, seems more likely. Until similar sites have been excavated, this question must remain unsolved.

The fact that stratigraphy was found is significant for New England archaeology. There are also suggestions that pottery may be made to give indications of cultural changes here as in other areas. The archaeological prospect for New England is not as hopeless as it may have been considered.

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[19] Hofmann, 1940, p. 23.

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Andover, Massachusetts
April, 1943

CHARLES R. SCOGGIN, 1914–1944

FRANK H. H. ROBERTS, JR.

AMONG the many student archaeologists serving in the armed forces of the United States, one of the first to make the supreme sacrifice was 1st Lieutenant Charles R. Scoggin. He was killed in action on Anzio beachhead, Italy, Feb. 2, 1944.

Lieutenant Scoggin, son of Dr. W. J. and Essie (Cartwright) Scoggin, was born July 10, 1914, at Bridgeport, Nebraska. He received his preliminary schooling at Chula Vista, California, and in 1927 moved with his parents to Ovid, Colorado, where he attended high school, graduating in 1931. Because of the depression, he was unable to continue his formal education at that time and in 1933 moved with his family to nearby Julesburg, Colorado. He was employed at Julesburg until the autumn of 1935 when he enrolled in the University of Colorado at Boulder. As it was necessary for him to work his way through college his attendance was irregular and he had not completed the hours requisite to a degree when the tide of world events swept him on to grimmer tasks in the summer of 1942. Had it not been for a deliberate choice, however, between obtaining his degree and completing as much as possible of the manuscript of an archaeological report he probably would have been able to graduate in June of that year. He was married on December 28, 1941, to Charline Knudson of Goodland, Kansas. In addition to her and an infant son, Charles Knudson, whom he never saw, he is survived by his parents, two sisters, three brothers, and his paternal grandmother.

Scoggin became increasingly aware of the fascinating possibilities of archaeology when as a school boy and young man he visited and revisited numerous eastern Colorado and western Nebraska sites in the general Julesburg area gathering surface specimens for his own collection. His desire to know more about the Indians and their cultures, not only of his own immediate district but for the country as a whole, grew apace and he read everything available on the subject. Gathering around him a group of friends with similar interests he instigated the formation of a study group. At this point an interesting case of parallelism, "psychic unity," or plain coincidence developed. In their discussions, Scoggin and his colleagues reached the conclusion that some kind of a general society for amateur archaeologists was desirable. All unknown to them a movement was then under way for the organization of a Society for American Archaeology, an association to serve both professionals and amateurs and to stimulate interest in American archaeology. The latter culminated in December 1934, while the plans of the

western group crystallized early in 1935 with the launching of the Society of American Amateur Archeologists. There were 27 charter members representing the states of Colorado, Nebraska, and Wyoming. Plans for the new society included the publication of a journal and Vol. I, No. 1, of *The Arch, a Monthly Survey of Amateur Archeology* appeared in July, the same month that AMERICAN ANTIQUITY, Vol. 1, No. 1, came from the press.

The Arch was the same size as AMERICAN ANTIQUITY, but it was printed in double column type rather than in the full page body adopted for the latter. The first number was devoted mainly to statements concerning the aims of the society and to a discussion of archaeology and the amateur. But in addition there were a short article about one of the larger local collections, four pages of drawings of specimens, and a map showing the location of the larger sites in the South Platte Valley in the Julesburg area. The second number appeared in August and the third and last in September. These issues contained more archaeological items than the first and, although somewhat amateurish in some respects, the journal showed promise of becoming a contribution. The editing was by Scoggin and many of the articles were written by him. The abrupt ending of *The Arch*—the September issue gave no indication that it was not to continue—resulted from a combination of factors. The membership had not increased as rapidly as anticipated, word about the national organization was spreading and potential members preferring the professional-amateur association joined it instead. Others were drawn to the Southwestern Colorado Archaeological Society (now the Colorado Archaeological Society) organized at Gunnison in May 1935 and its quarterly *Southwestern Lore* of which Vol. I, No. 1, appeared in June 1935. Furthermore, Scoggin had made up his mind to go to college that fall. As a consequence, it was necessary to suspend *The Arch;* the society, without his active leadership, soon became defunct. Scoggin personally, however, liquidated all of the obligations that had been incurred, paying off a little at a time as he worked his way in college.

In the summer of 1936 he joined the party under the writer's direction at the Lindenmeier site in northern Colorado, returning each of the four succeeding seasons that work was carried on there. As a result of his experience in the field, and from the knowledge gained in his classes at the university, he became an exceedingly valuable workman, so much so that he was left in complete charge of the camp and excavations for a period of six weeks during the final season in 1940.

In November, 1939, he made a trip to the Yampa Canyon in the eastern part of Dinosaur National Monument, northwestern Colorado,

in company with Hugo G. Rodek, director of the University of Colorado Museum, to inspect a number of archaeological sites. The situation was so promising that Scoggin was sent there, with Edison P. Lohr as his assistant, to carry on a survey and do some excavating. The two were in the field from December 12, 1939, to May 30, 1940. During this period they mapped the Castle Park area, located sixteen rock shelters and caves showing traces of occupation, fifteen sites in the open, and seven groups of petroglyphs. Test trenches were dug in a number of sites and extensive excavations were made in Mantle's Cave, the largest of the shelters. Numerous specimens and excellent data were obtained from these efforts. Scoggin worked on this material and attended classes throughout the fall and winter 1940–41. From July 1 to September 30, 1941, he was back in the Yampa country as a temporary ranger for the National Park Service in Dinosaur National Monument. At this time he expanded his survey to cover the eastern end of the Monument and prepared a map showing the location of all sites found. Instead of completing the requirements for his degree during the fall, winter, and spring of 1941–42, he served as an assistant in the University Museum and devoted most of his time to cleaning and studying the specimens he had collected and in working on his Yampa report. He felt that it was only a matter of months before he would be called for service and desired that the record be as complete as possible when he left, even though his personal affairs might suffer thereby. From May 27 to June 15, 1942, with the permission of his draft board, he again served as a temporary ranger at Dinosaur National Monument in order to accompany a party of National Park Service officials on an inspection of sites in Yampa Canyon and along the Green River below the junction of the Yampa.

Scoggin entered the army July 22, 1942, through selective service. He received his basic training at Ft. Leonard Wood, Missouri. From there he was sent to the Officers' Candidate School at Ft. Belvoir, Va., and was commissioned a 2nd Lieutenant in the Corps of Engineers on Jan. 29, 1943. He immediately volunteered for assignment to the First Special Service Force at Ft. William Henry Harrison, Montana. This organization, comprising United States and Canadian troops, was undergoing mountain and paratroop training in preparation for commando work. Appropriately enough, as far as Scoggin was concerned, the shoulder flash of this unit was a spearhead and the collar insignia crossed arrows. The Force later practiced amphibious landings at Camp Bradford, Virginia, and then moved to Ft. Ethan Allen, Vermont, for further hardening. In the early summer it went to Amchitka Island in the Aleutians where 20 days and nights were devoted to intensive preparation for the landing on Kiska. Because the enemy had already

withdrawn, it remained there only 5 days. Despite the busy time on Amchitka, Scoggin found opportunity to note many middens and village sites and to pick up a representative lot of specimens. While on Kiska he was promoted to 1st Lieutenant. From Kiska the Force returned to Ft. Ethan Allen and, in October, embarked for North Africa. From there it went to Italy and joined the Fifth Army, seeing active service in the Cassino sector until withdrawn in January to form a part of the spearhead for the Anzio landings.

Being at the start of an archaeological career, Scoggin leaves little published material. Except for his numerous short articles in *The Arch*, about which he was extremely and unduly sensitive, his main paper was "Folsom and Nepesta Points" in Vol. V, No. 4, pp. 290–298, of AMERICAN ANTIQUITY. His manuscript "Preliminary Report of the Archeological Field Work of the University of Colorado Museum in Yampa Canyon, 1939–1940" is one of the best ever sent to the Smithsonian Institution in compliance with the permit regulations of the Antiquity Act and might well serve as a model for many professionals. The manuscript "Report of Reconnaissance in Dinosaur National Monument, Season 1941" made to the National Park Service is well done and supplements the previous one. He collaborated with Gordon C. Baldwin and Frank M. Setzler in preparing the "Yampa and Green River Archeological Survey" of which several typescript copies are on file in Park Service offices. His main paper on the Yampa was not wholly finished but it was left in such form that it could easily be prepared for publication. Referring to it one of his professors writes: "It is a very rich, accurate, and beautifully worked out report, with all details tabulated, photographs and drawings complete and in order, and everything, I believe, which is necessary for a valuable publication."

Scoggin had been a member of the Society for American Archaeology and belonged to the Boulder Chapter, which he served as president 1941–42, of the Colorado Archaeological Society. He was a very capable and promising young man and probably would have made his mark in the field of American archaeology had he been permitted to continue his career. He was a hard and enthusiastic worker whose chief fault, if it can be so called, was so overwhelming an interest in archaeology that it was difficult to hold him to any routine not directly concerned with it. In moments of relaxation, however, he penned excellent little essays and wrote better than passable poetry. Despite a tendency to occasional spells of moodiness, he was a likable chap who will be greatly missed by all who knew him.

Smithsonian Institution
Washington, D. C.
July, 1944

FACTS AND COMMENTS

ON THE TYPOLOGICAL METHOD

The article, "The Typological Concept," recently published by Alex D. Krieger[1] is an encouraging sign that interest in methodology, hitherto confined largely to field work, is now turning as well to the study of specimens in the laboratory. Krieger is to be congratulated for outlining clearly his method of forming types and for a penetrating comparison of that method with other archaeological procedures of classification.

It may be questioned, however, whether the article contributes as much to an understanding of the typological concept as it does to the typological method. In emphasizing the formation of types, Krieger fails to explain what he means by the term "type." As the present writer understands his remarks, the term "type" is used variously to refer to the categories formed by classifying artifacts (pp. 271–272), to the specimens classified within each category (bottom of pp. 277, 281), and to the pattern of characters used to define each category (pp. 278, 280). Examination of the article reveals that type-specimens, single characters of the specimens, and variable patterns of characters are not types, but negative statements like these are the only apparent contribution to our comprehension of the concept of type as such. It is not even suggested that archaeologists define what they mean by type, although they are advised to explain their manner of forming types.

The value of Krieger's methodological discussion is marred by several other minor defects. Historical study need not be limited, as he implies, to the kind of classification based upon patterns of characters of artifacts. It should be possible to study historically the units of any classification, even if based upon only a single character of each artifact, *providing that it is realized that one is tracing the history, not of the patterns of characters associated in Krieger's article with types, but only of the characters which have been used as the basis for classification.* The grouping together, for example, of stone, shell, and metal objects in the Mississippi valley because they have in common a single kind of design is a prerequisite for studying the history of the design, even though, as Krieger states, it contributes nothing to the history of the type involved. This was the point which led the present writer to make the distinction between mode and type to which Krieger refers in another connection. Separation of modes, formed by classifying the artifacts in terms of single characters, from types, based as in Krieger's article on combinations of the characters, made it possible to study the history of either single or multiple characters, or of both, without confusing the two.[2]

Exception might also be taken to Krieger's conclusion that a typologically minded archaeologist will name his types (or modes) descriptively, rather than in terms of letters and numbers. If interpreted literally, both descriptive terms on the one hand and letters and numbers on the other can lead to bias, the former because they emphasize certain characters of the artifacts or certain sites, and the latter because they have an inherent order. Choice between the two would therefore seem to be a matter of style rather than of logic. Some writers, for example, may find it more satisfactory to state that the ovoid design has diffused from Haiti to Puerto Rico, replacing the vertical-parallel-line design on the latter island, than to draw the same conclusion in terms of designs Ia1 and IIb2, but the choice is likely to be a personal one.

In outlining the typological method used in classifying Southeastern and Southwestern pottery, Krieger makes no mention of the practice of setting up a type-specimen

[1] AMERICAN ANTIQUITY, Vol. 9, No. 3, 1944, pp. 271–288.

[2] Irving Rouse, *Prehistory in Haiti, A Study in Method*, Yale University Publications in Anthropology, No. 21, New Haven, 1939.

as the standard for each pattern of characters formed through classification. Yet the Southwestern conferences of 1929 and 1930 recommended that "a specimen of the type should be deposited in a museum with an appropriate label to indicate that it is the type-piece on which the description is based."[3] Apparently, this proved to be impracticable, for in the reports cited by Krieger each description is actually based upon a number of specimens. The present writer is not familiar enough with the work in the area to know whether several type-specimens were thereupon set up in place of each single specimen originally envisaged, but this would seem to be the logical development.

In any case, the failure of the plan for setting up single type-specimens in connection with Southwestern pottery study need not automatically preclude its application to non-ceramic specimens. Experience has shown that in dealing with most stone, bone, and shell artifacts one does not encounter the large number of alternatives in shape and decoration which are met with in pottery analysis.[4] As a result, when classifying non-ceramic artifacts in terms of patterns of characters, one can usually select a single specimen to illustrate each pattern, instead of the several specimens needed to exemplify a pattern of pottery characters. This would seem to justify the current practice of establishing a type-specimen, or "perfect example" of each pattern, in connection with the classification of stonework.[5]

As one especially interested in drawing historical conclusions, the present writer is perhaps in a position to criticize objectively the current tendency, particularly among archaeologists in the Southeast, to value history as the *sine qua non* of archaeological research. He cannot see why, for example, the work of Fewkes in pointing out the varieties of cultural objects in existence in the West Indies, their artistic significance, and the manner in which they have been used in the native cultural activities, should be considered less valuable than the historical research of later writers, based as it is on a different kind of typology. The two would seem to complement each other and to enrich our knowledge of the archaeology of the West Indies in a way that would not have been possible if only the historical work had been done.

Archaeologists who have this comprehensive point of view may question Krieger's assumption that the only types of value are the ones formed for purposes of historical study. It is possible, for example, that a person interested in the processes of stone working may find as much use for types selected on the basis of individual variations as for those based upon characters of historical significance. Different approaches to typology may prove to be the best suited to different kinds of study.

The above remarks are intended to amplify rather than to belittle Krieger's discussion of the typological method, with which the writer is in essential agreement. Several additional aspects of the procedure of forming types may also be mentioned. Should the archaeologist classify potsherds and other fragmentary artifacts in their present condition or as complete artifacts? Should he base the classification only on characters appearing on the artifacts, or should he include also inferences as to the manufacture and use of the artifacts? Should he use as the basis for classification only characters which are present on every specimen in the group, or should he also take into consideration characters which some specimens in the group do not have? To what extent should he rely upon his visual impression of each character, and to what extent should he use the various terminologies developed in recent years to refer to the different kinds of parts of

[3] H. S. and Winifred Gladwin, *A Method for the Designation of Southwestern Pottery Types*, Medallion Papers, No. 7, Globe, 1930.

[4] Irving Rouse, *Culture of the Ft. Liberté Region, Haiti*, Yale University Publications in Anthropology, No. 24, New Haven, 1941.

[5] E.g., Douglas Byers and Frederick Johnson, *Two Sites on Martha's Vineyard*, Papers of the Robert S. Peabody Foundation for Archaeology, Vol. 1, No. 1, Andover, 1940.

artifacts? Until agreement can be reached upon such questions (if ever it can), it will probably be best, as Krieger recommends, to explain carefully one's classificatory procedure; it may also be well explicitly to define one's conception of a type.

IRVING ROUSE
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A BONE ATLATL HOOK FROM OHIO

Since there appears to be no record of an atlatl hook from Ohio, it may be of interest to note the finding of a specimen in a rock shelter. This shelter is located under a sandstone bluff in the NW ¼ of Section 15, Goodhope Township, Hocking County, Ohio. It faces east, overlooking the Hocking River Valley, and is just west of U. S. Route 33 and Brushy Fork, which flows into the Hocking River at this place. The shelter is about

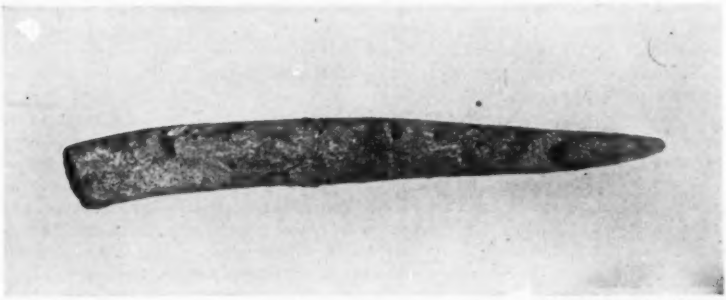

Photo courtesy R. G. Morgan

FIG. 13.—Bone atlatl hook from Goodhope Township, Hocking County, Ohio.

thirty feet long and fifteen feet from the front to the back wall. The floor has been previously dug over, a condition which has existed at least since 1927, when it was first seen by the writer.

On March 28, 1943, Mr. H. R. McPherson of Columbus and the writer visited this shelter and examined a portion of the floor near the back wall. In the disturbed dirt, at a depth of about two feet and a few inches from the back wall, a section of a deer antler tip was found by Mr. McPherson and given to the writer. The specimen was encrusted with sand, but examination revealed that the large end had been cut off and bore a drilled hole. The object was broken when found but the two pieces were together and constitute the complete specimen. The only other objects found were a few animal bones and mussel shells and one small, grit-tempered piece of pottery.

When the encrusted sand was removed from the specimen a knob was found cut into the curved surface of the antler 30 mm. from the tip. The cutting around the sides and in front of the knob had flattened the surface of the antler at this point. The knob was slightly rounded off rather than pointed. The large end of the antler was cut off smooth and a cone-shaped hole with diameters of 15 mm. and 10 mm. was drilled 82 mm. into the base of the specimen. The hole thus extended slightly less than half the length of the entire specimen, which is 172 mm. long. There was no smoothing or working, other than the notch and the hole, on the surface of the antler. This atlatl hook is similar

to specimens reported from the Chiggerville site[1] and the Cypress Creek Villages[2] in Kentucky and from the Bluff Creek site Lu[3] 59 in Alabama;[3] these sites are considered by Webb to belong to an early archaeological horizon. While the cultural and chronological position of the Ohio specimen is not known, it may be as old as those referred to from the south.

ROBERT GOSLIN
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A CRYSTAL ARROW POINT

Approximately eighteen miles north of Vernon, Wilbarger County, Texas, is Cedar Bluff. It is not as imposing as the word "bluff" may imply, but, in comparison with the low hills and level farm lands of this area, it deserves the name. It is a terrace, about two miles in length, which forms the west bank of Red River at a bend in that stream. The approach to Cedar Bluff is of sandy soil which is of good quality for farming and is mostly under cultivation. Crops are grown in most places to the very edge of the bluff. The face of the cliff shows some water erosion. The general formation consists of an upper layer of sand on gravel; underneath this are horizontal layers of limestone bedded in shale which are underlain in turn by a deep formation of sandstone and red bed material of Wichita Permian. A few sheltered places formed by projecting limestone and a few excavations made by spring water in the sandstone section of the cliff are inadequate for habitation.

FIG. 14.—Crystal arrow point from Cedar Bluff, Wilbarger County, Texas.

The margin of Cedar Bluff is broken in several places by gorges which are hundreds of feet in width. These features, varying in depth, are often a thousand feet or more in length. Between them the rim of the bluff appears to project out further above the bed of Red River, which spreads out some 200 feet below. At one of these places, known to us as Ethel's Point, we picked up the arrow point which we have known since as the "crystal." An interesting characteristic of this elevation is the view it affords of the surrounding country. Here the course of Red River is visible for miles in both directions; across the stream is a wide expanse of level sand flanking the mouth of another river. This stream, the North Fork, enters Red River from the north across the level plains of Oklahoma.

Historical interest has been directed to this area of North Texas because of several cattle trails which converged here. Among these, the Chisholm Trail and Western Cattle Trails are the names best known to Texans. The crossing of Red River here was known to cattlemen as Doan's Crossing because of the fact that Doan's Store and Trading Post was established in the year 1878 near the south tip of Cedar Bluff. At Ethel's Point and

[1] W. S. Webb and W. G. Haag, *The Chiggerville Site*, Reports in Anthropology, Publications of the Department of Anthropology and Archaeology, University of Kentucky, Vol. IV, Number 1, 1939.

[2] W. S. Webb and W. G. Haag, *Cypress Creek Villages*, Reports in Anthropology, Publications of the Department of Anthropology and Archaeology, University of Kentucky, Vol. IV, Number 2, 1940.

[3] W. S. Webb and D. L. DeJarnette, *An Archeological Survey of Pickwick Basin in the Adjacent Portions of the States of Alabama, Mississippi and Tennessee*, Bureau of American Ethnology, Bulletin 129, Washington, 1942.

five other places along this terrace are evidences of Indian habitation. Each of these sites has yielded artifacts from the surface. Camp debris is not so extensive as to suggest continued occupation.

The crystal arrow point is of the small triangular type with slightly concave base; it is minutely chipped and its transparency and beauty set it apart from all other points we have seen. It is 30 mm. in length and is 10 mm. wide at the base.

We have been rendered valued service by Mr. Alex D. Krieger, of the Department of Anthropology, University of Texas, in establishing the unusual purity of this specimen. He has also given us information concerning the use which aborigines are known to have made of this type of material. The purity of the specimen would closely identify it with crystals which occur in the vicinity of Hot Springs, Arkansas. Since there is no other obvious source of the material in this part of the United States, this would seem to have been its origin. The known use of these crystals by aborigines is confined to ornamental objects which were used as pendants; small pieces were utilized as scrapers. Very little chipping was done in either case.

This point is the only specimen of this extremely hard material worked into a beautiful artifact that we have seen. We cannot offer any information as to just how this job was accomplished. The material is unusually pure crystal. There is no doubt that it is quartz, but it is not the common quartz with impurities which is used for other "quartzite" artifacts.

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REPLY TO A. D. KRIEGER'S REVIEW OF L. S. CRESSMAN'S *ARCHAEOLOGICAL RESEARCHES IN THE NORTHERN GREAT BASIN*

The character of Mr. Krieger's review of my book, *Archaeological Researches in the Northern Great Basin*, Publ. 538, Carnegie Institution of Washington, in AMERICAN ANTIQUITY, Vol. IX, No. 3. pp. 351–359, raises the whole problem of what the nature of a review of a scientific paper should be, in addition to certain points concerning the particular book under consideration. The function of a review, as I have always understood it, is to present a critical evaluation of a study giving the hypothesis which is the subject of verification, the major and minor premises upon which the argument is based, and the other aspects of the work necessary to present an accurate picture of the book. This material the reviewer should then evaluate in terms of the adequacy with which the author has used it. This, of course, includes not only the critical evaluation of the soundness of the method, but the adequacy and relevance of the materials and the reliability of the conclusions which may be based upon them. Furthermore, if there is anything outstanding about the book, especially in its contribution to the particular field of knowledge, either in the subject matter or method, attention should be called to that and an evaluation placed upon it with reference to its significance for further development of work in the field. If the work is inadequate and the conclusions are not substantiated by the evidence offered, this condition should be objectively and impersonally pointed out. It is extremely seldom that this type of review is found today in the scientific periodicals. The general aim too often seems to be, by choosing a series of points with which the reviewer does not agree, to discredit the writer as far as possible, although sugar-coating the pill by some platitudinous remarks about the excellence of the typography or the illustrations. It is extremely rare today that the reader can go over a review and be confident that he knows what the book is really about and at the same time feel that he has read a sound evaluation by a competent, impartial critic of a book he ought to read.

Certain important aspects of my work, cooperative attack and mutual checking of results, had attention called to them in the Foreword by Dr. John C. Merriam. Dr. Merriam wrote:

> The other aspect of science which I have in mind concerns study of the particular problem in hand by comparison with materials from other closely or distantly related subjects that may have possible bearing upon the research. In other words, in advancing science it is important both to secure new factual materials and to see them in the perspective of knowledge broadly. Not infrequently some of the greatest contributions from particular studies have come through the illumination made possible by work in related fields. . . . In the annual report of the Carnegie Institution in 1939, I pointed to the cooperative project on the study of early man and the culture of the northwest being carried forward by Dr. Cressman with the assistance of ten or more distinguished investigators in fields ranging through anthropology, archaeology, paleontology, geology, history of climate, and other related subjects.

While this cooperative attack is by no means new in North American archaeology, we had the good luck to work in an area where it has probably been most effective because these sciences could be used for mutual aid and checking one another's results. The review under consideration fails to give the reader any true idea of this nature of the work or its implications. The archaeological material from the Oregon caves hung suspended in time and space until by a fortunate circumstance we discovered the Paisley Caves with occupational material separated by layers of pumice. Dr. Howel Williams, at that time working on the history of Crater Lake, was able to identify the source of this pumice and to establish the period of volcanism during which it was ejected. By means of this dating Dr. Williams thus put our archaeological work in a chronological frame of reference that defined the problem to which this book was devoted. This problem is not stated at all by the reviewer, although I quoted it, partly in italics, on p. 3, as follows:

> His (Williams', referring to the dating of the pumice separating occupational layers in the Summer Lake Caves) minimum date is 5,000 years, his maximum, 10,000. To repeat, then, it is the stratigraphic evidence from the caves near Paisley and the Summer Lake basin that has given point to, and framed the question of, the relationship *of the culture of the caves of south-central Oregon in the northern Great Basin to the widespread Basket Maker type and the classical, or San Juan, Basket Maker of the Southwest.*

Since the soundness of my interpretations depends upon the validity of the generally accepted climatic history of the Great Basin and the geological chronology given by Williams, I shall devote most of my reply to Krieger's criticism of these points, with special reference to the latter. First, however, certain other points raised in the review need to be discussed, since they bear directly or indirectly upon the scientific integrity of the writer.

One of these statements refers to the stratigraphic location of flexible (Catlow Twine) basketry in Lovelock Cave, p. 357. The stratigraphic sequence in Lovelock Cave poses an extremely difficult problem, as everyone who is familiar with its history knows. However, it would seem that the persons most competent to deal with it are the men who directed the work and published the results, Loud and Harrington.[1] They discuss the cultural stratigraphy of the cave based on the 1924 excavations, pp. 18–28. The 1912 excavations were carried out under conditions that made "stratigraphic work not feasible," (Loud and Harrington, p. VII). Krieger, footnote 10, p. 357, states, ". . . the numerous cave 'lots' of Loud in 1912 can be used to supplement the 'stratigraphic record'," but fails to indicate how. On p. 26, Harrington, in the section on the 1924 excavation and stratigraphic distribution of basketry, limits the flexible twined basketry to the "Early" or lower 3 levels. Yet Krieger writes, "What I especially want to point out is that the few fragments of Catlow Twine found in Lovelock and Humboldt Caves are definitely connected with the *top and surface lots* (italics Krieger's) in the former cave and with the upper half of the latter" (p. 357). Krieger writes, "If Cressman later examined the Heye

[1] L. L. Loud and M. R. Harrington, *Lovelock Cave*, University of California Publications in American Archaeology and Ethnology, Vol. 25, No. 1, University of California Press, Berkeley, California, 1929.

specimens. . . ." These were examined along with the catalog, as stated in the text, both at the Museum and the storage building, and the evidence as found and recorded corroborates that of Harrington.

Krieger states that he brought for my examination in 1938 specimens from the University of California. These are referred to in Cressman, Williams and Krieger, p. 12.[2] There were two specimens (apparently Catlow Twine from *Loud's 1912 Collection*) to which, I suppose, Krieger refers as evidence to confute the Lovelock authors and me. He, however, omits to say that he then took the position that Loud's work had no stratigraphic significance, for it was simply a series of unrelated pits. He fails now to explain his reversal of position and contradiction of the statement on p. VII of Loud and Harrington's monograph quoted above. Only the publication of the Humboldt Cave report will furnish us with the needed evidence to clear up that situation.

The reviewer's omission of certain facts in his statement concerning the finding of the *Equus* bone in Catlow Cave No. 1 is misleading. The location of this bone is described in Cressman, Williams and Krieger, p. 10, and there seemed then to be no reason to give all the details of finding it. They are as follows: Krieger and others, working at the place described, saw, as he says, this bone fall from its resting place some distance below the surface from which it was loosed by the digging. He does not add that I immediately had him indicate the point from which the bone fell. We then established its vertical and horizontal location with reference to the fixed datum of the Cave, by use of a Brunton compass. My field notes give the evidence by which the location was fixed and it is as given in the paper referred to. The significance of the bone may be open to discussion, but not the details of the fact of finding and locating it. Nor can the fact that it is partially fossilized *Equus* bone be dismissed.

On p. 356, Krieger criticises my failure to mention the arrow points in my summary, apparently indicating the need for a comparison of these of the Oregon Caves with those of Lovelock Cave. He then states, "Certainly Cressman is aware of the fact that the lower three of the six Lovelock levels, as well as Basketmaker sites, lack the bow and arrow, *hence, this omission is perhaps not accidental*" (italics mine). Loud and Harrington, p. 108, report only 11 arrow points for Lovelock Cave, with no stratigraphic evidence. How these can be used for comparative purposes I do not know, nor does Krieger show how. Such a comparison could have no scientific value. Loud and Harrington use the size of shafts as the basis for distinction between kinds of projectiles, a procedure open to doubt, as is the use of size of point. The different size of atlatls from the Oregon Caves shows that size of projectile point alone is not a sound basis of distinction. Morris[3] has given evidence that the bow and arrow was in use in BM II times, at least by enemies with whom the Basketmaker were in conflict. This certainly indicates that the bow and arrow was by this time an established weapon of tribes pushing into the Southwest from a generally northward direction, and probably even then had a long history.

Krieger seems to be under the impression that I was trying to date the Oregon materials by means of the Lovelock Cave specimens. This is entirely in error, for the Lovelock Cave material has been suspended in time and space. The Oregon materials in terms of the geological stratigraphy are the point of reference. On p. 357 he refers to the "stratigraphic evidence" as apparently the references to Lovelock Cave, missing entirely the point clearly brought out in the Foreword, and the Introduction, that the basic fact in the chronology is the stratification by pumice of known origin in the Summer Lake Caves; then the Lovelock and Basketmaker artifacts through an effort at cross identification and use of known age of deposits are arranged accordingly.

[2] L. S. Cressman, Howel Williams and Alex D. Krieger, *Early Man in Oregon*, University of Oregon Monographs, Studies in Anthropology, No. 3, Eugene, 1940.

[3] Earl H. Morris, *Archaeological Studies in the La Plata District*, Publication 519. Carnegie Institution of Washington, 1939, p. 19.

On p. 353, referring to atlatls from Roaring Springs Cave, the reviewer states, "Neither are there two forms from this cave. . . ." Krieger does not seem to have read p. 69 where I wrote, ". . . and if our hypotheses about hooks and fragments are correct. . . ." There is a big difference between this and a bald statement that there were two forms from Roaring Springs Cave, which he says a reader might infer. This possible inference Krieger then denies and attacks as though I had made an unqualified statement to this effect.

On p. 353 the statement is made that "Tables 13–14, which give the elevation above sea level of each sandal in Catlow Cave, are a waste of paper." Of course, the purpose of the tables is to determine the order of appearance of the different types of sandals in the Cave as an aid in determining relationship to those in other caves, especially Fort Rock, as the discussion in the text indicates. That the elevations are given in feet above sea level, the information which seems to distress the reviewer, is due to the fact that our datum point was established by running a level from the U. S. C. G. S. bench mark which indicated a point above sea level (p. 22).

One further reference to this aspect of the review needs to be made. On p. 358, discussing the L-shaped scapula awls, Krieger states, "The connection with Basketmaker is questionable." This is directly contrary to fact, as my carefully documented record shows. The interpretation I have placed on the association may be questionable, but not the fact of "connection."

The reader can check the other points raised in the review by the internal evidence of the monograph.

The criticism of the chronology of the climatic and geological features of Great Basin history upon which I have drawn indicates either inability of the reviewer to control the literature or a selection of incidental material to support a thesis in conflict with the best evidence established by distinguished specialists in the fields of physiography, climate, volcanism and paleobotany. He refers to Jones' work, giving the age of the Lake Lahontan maximum as 1,000 years ago and says, "Jones was, nevertheless, the only geologist who attempted to date Lahontan by objective methods" (p. 355). See Antevs' statement following this. Krieger does not mention the numerous studies of Kirk Bryan and of Antevs, that of Matthes on glaciation, or that of Hansen on paleobotany, all of which contradict Jones' thesis.

There are two phases to the chronological problem of this study, first the postpluvial climatic history of the Great Basin; and second the time of the violent explosive volcanism of Mt. Mazama which deposited the pumice in the Summer Lake Caves, and *not the final dying* activity of the mountain which built up Wizard Island. In this study we followed the convincing evidence of the numerous authorities in the field on the postpluvial climatic history of the Great Basin.

The second point in the chronological argument, and the one of greatest significance for the problem to which my book is devoted, in fact which formulated the problem, is the age of the *violent explosions which formed the crater in which Crater Lake now lies, and which deposited pumice in the Summer Lake Caves* some 60 miles to the east, and slightly south. Williams, whose book came out too late for me to use, gives seven criteria,[4] as Krieger reports, upon which he bases his evidence that the minimum age for this volcanism was about 5,000 years ago. Krieger, however, *omits the discussion of these*, although they generally corroborate one another, and concentrates on the final, or eighth, statement, which gives a minimum date since which the formation of the crater could not have taken place. This represents the final volcanism which formed Wizard Island. Krieger makes much of Williams' statement that a "short time" elapsed between the violent

[4] Howell Williams, *The Geology of Crater Lake National Park, Oregon*. Carnegie Institution of Washington, Publ. 540, 1942, pp. 112–114.

volcanism of pumice ejection and the dying activity of the mountain. However, the objection loses its point when it is remembered that Williams is speaking in geological terms and not of human history.

Williams, in a letter to Cressman under date of February 29, 1944, relative to this review, wrote:

> After rereading my own remarks concerning the age of Crater Lake, I agree with you that he [Krieger] seems to have missed the point somewhat, not realizing that the final eruptions of Wizard Island by no means date the origin of the caldera. I said that they furnish a minimum date, but then I might as well have said that 1853 provides a minimum date for that was when Hillman discovered the lake! As far as the geological evidence now leads us, I see no reason for modifying the view that the great eruptions of pumice which led to the formation of the caldera occurred between 4,000 and 7,000 years ago, toward the end of a long dry period and shortly before the present pluvial cycle began.
>
> Of the various criteria that seemed to me to throw light on the question, Krieger unfortunately discusses only one, namely the evidence offered by the trees on Wizard Island. These suggest, as you know, that the concluding eruptions within the caldera took place approximately 800 years ago. But everything hinges, of course, on the interval between that activity and the great explosions of pumice. Just how long that interval was must remain, for the present at least, a matter of speculation. Writing as a geologist, I said that the interval of quiet following the collapse of Mount Mazama was "probably short." Yes, from the geological standpoint it was, yet it may have been tens, hundreds or even thousands of years.
>
> . . . For an estimate of the age of the great pumice eruptions of Mount Mazama, reliance must therefore be placed on the seven criteria not discussed by Krieger, namely on the evidence relating to the size of the glaciers and the nature and distribution of the forests that clothed the volcano at the time, and the degree to which the deposits of pumice have since been eroded. Admittedly the evidence is at present inconclusive, but taken as a whole it seems to show that the pumice was blown out at least 4,000 years ago.
>
> . . . And again, if the peak of Mount Mazama still existed less than a thousand years ago, and if it be admitted that when the peak disappeared glaciers on the *south* side still descended to levels between 6,250 and 6,500 feet, we should expect to find abundant, extremely youthful moraines far down the sides of many Cascade cones, but fresh, loosely compacted moraines are never found in such positions.

Hansen has also furnished evidence on the age of the pumice deposition:

1. Average depth of 30 pollen-bearing profiles (mostly peat) that lie upon glacial drift or its chronological equivalent in the Pacific Northwest—7.2 meters.
2. Using 15,000 years as the length of post-glacial time, rate of peat deposition—more than 2,000 years per meter.
3. Average depth of 9 pollen-bearing profiles resting upon Mount Mazama pumice in the southern Oregon Cascades—2.2 meters. At average rate of 2,000 years per meter, time since Mount Mazama eruption—over 4,000 years.

Add to this the time necessary for vegetation to become established on sterile pumice and we have approximately 5,000 years.

Finally, Krieger says that the discussion of the Lower Klamath Lake area where the chronology is based upon supporting studies by Anters, Hansen, Allison and Smith is adequate. He says the same about Paisley 5-Mile Point Cave No. 3. Yet both of these sites fit into the generally accepted Basin chronology as outlined above, and the present stated time of the deposition of Mount Mazama pumice. How these discussions which utilize the same chronological sequence as the rest of the study can be "adequate" when that sequence is denied for the Basin it is impossible to see. Obviously the reviewer contradicts his whole argument.

One gets the impression from reading Krieger's review that he had an intimate knowledge of the Oregon materials upon which the book is based. Krieger's first-hand experience with these materials was limited to certain periods during his stay here as a graduate student and part-time member of the staff of the Department of Anthropology from October 1, 1937 to October 1, 1939. During this time he was a member of the field party of 1938, although he did not complete the field trip. His other connection with the material is represented by the joint article quoted above, and a preliminary classification of the twined basketry, mats and sandals which I employed him to make in 1939, plus the casual knowledge he gained while others were cataloging the materials.

The conclusions formulated in my study represent hypotheses subject to verification. They are the best that can be offered on the basis of a critical, systematic study by experts from all the different fields that may throw light on the questions. The conclusions advanced are new concerning western prehistory. In view of the information now available they make a consistent pattern subject to change by further research and under the impact of rigidly scientific criticism.

L. S. CRESSMAN
University of Oregon
March 30, 1944

REGARDING J C. JONES' DATE FOR LAKE LAHONTAN

Mr. Alex D. Krieger's (pp. 355, 359) reference to the late J C. Jones' date for Lake Lahontan calls for some clarifying comments. Lake Lahontan, the ancient lake in northwestern Nevada which occupied 8500 square miles and reached several hundred feet above the modern lakes in its basin, Professor Jones believed, was not, as generally held, contemporaneous with the extensive Pleistocene glaciations in the adjacent mountains,[1] but "the Lahontan stages occurred during the present era, with the survival of the fauna till the last thousand years" (1933, p. 96). The extinct fauna referred to included horses, elephants, camels, and *Felis atrox* (1925, p. 49; 1929, p. 539). Jones (1925, p. 4) did not correlate Lake Lahontan with other ancient lakes in the Great Basin, did not discuss their relationship, and objected to my introducing the obvious sister-lake in western Utah, Lake Bonneville, into the discussion.

The most important evidence in Jones' dating was the low salinity of Walker Lake (1925, p. 46; 1929, pp. 539–540), because this lake lacks an adjacent evaporation basin by which it could have become freshened. However, this low salinity is readily explained by the evident fact that the main tributary, the Walker River, for part of the postpluvial, or post-Lahontan, age discharged into Carson River via Churchill Canyon.[2] The small amount of salts in other basins is also explainable without unreasonable assumptions.[3] There is consequently no basis for Jones' strange beliefs and dating, and no excuse for Krieger's employing them in a criticism. Lake Lahontan was simply the second largest of the many pluvial Great Basin lakes whose relationship to the extensive Pleistocene glaciations is now fairly well known and whose last maximum was attained somewhat less than 25,000 years ago.[4]

ERNST ANTEVS
Globe, Arizona
March 30, 1944

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[1] J C. Jones, *The Geologic History of Lake Lahontan*, Carnegie Institution of Washington, Publication No. 352, 1925, pp. 1–50.

J C. Jones, "Age of Lake Lahontan," *Bulletin of the Geological Society of America*, Vol. 40, 1929, pp. 533–540.

J C. Jones and V. P. Gianella, "Reno and Vicinity," *XVI International Geological Congress, Guidebook 16*, pp. 96–102, Washington, 1933.

[2] Ernst Antevs, "Pluvial and Postpluvial Fluctuations of Climate in the Southwest," *Carnegie Institution of Washington Year Book*, No. 35, 1936, pp. 322, 323.

[3] Ernst Antevs, *On the Pleistocene History of the Great Basin*, Carnegie Institution of Washington, Publication No. 352, 1925, pp. 51–114. See pp. 76, 102.

Ellsworth Huntington, *Tree Growth and Climatic Interpretations*, Carnegie Institution of Washington, Publication No. 352, pp. 155–204. See pp. 197–199.

[4] Ernst Antevs, *Age of the Cochise Culture Stages*, Medallion Papers No. 29, pp. 31–56, Gila Pueblo, Globe, Ariz., 1941. See p. 40.

BOOK REVIEWS

Notes on Middle American Archaeology and Ethnology. (Carnegie Institution of Washington, Division of Historical Research; Vol. I, Nos. 1–30. 204 pp., including 37 of illustrations. Cambridge, 1940–1943.)

This valuable new series was inaugurated in order "to give circulation to those random bits of information which all anthropologists accumulate in the field, the museum and the library," but which would, in the usual course of events, be considered too unimportant, too brief, or too restricted in field to be submitted for publication. However, in practice, the papers have not been limited to a record of facts, nor exclusively to the Middle American field. Two important ones on Maya epigraphy announce new theories, and one concerns Peruvian archaeology. Such short notes are, nevertheless, often of great interest to the specialists for whose use they are designed and to whom their distribution is restricted. Those in the present volume are from a minimum of 2 to a maximum of 18 typescript pages in length; the average is only 6.8 pages. While intended primarily as an outlet for the staff of the Carnegie Institution, short contributions from other workers are welcomed, and a number of such outsiders are represented in this volume. The editor, J. Eric S. Thompson, and the head of the Division, A. V. Kidder, have between them contributed sixteen of the thirty articles that compose this first volume. Illustrations in line drawings, half-tone, or collotype accompany many of the articles.

The majority of the papers are on archaeological topics, among which those on Mayan archaeology are naturally most numerous. One is on Totonac, one on Central America, and one on Peru. The two ethnological articles have an archaeological background. The next largest group of topics concerns epigraphy, codices, chronology, and the calendar; in this the Aztec (or Puebla-Mixteca) field almost equals the Maya in point of number of articles. One lone paper on Maya phonetics sticks out like the proverbial sore thumb. All of these present new data or points of view of importance, often of great importance, to specialists. Present limitations of space, however, prevent abstracts or appraisals of all, and any one might be considered as of outstanding importance according to the personal interests of the chooser. An excellent seven-page index makes the volume the more useful.

The topics of the thirty articles are given below, arranged according to author, and, as far as possible, grouped as to subject-matter. The final number gives the order of the paper in the volume.

A. V. Kidder:
- Archaeological Specimens from Yucatan and Guatemala (9)
- Spindle Whorls from Chichen Itza, Yucatan (16)
- Clay Heads from Chiapas, Mexico (1)
- Pottery from Champerico, Guatemala (2)
- Pottery from the Pacific Slope of Guatemala (15)
- Grooved Stone Axes from Central America (29)

E. Wyllys Andrews:
- The Ruins of Culuba, Northeastern Yucatan (3)
- An Ethnological Note from Cilvituk, Southern Campeche (5)

Linton Satterthwaite, Jr:
- New Photographs and the Date of Stela 14, Piedras Negras (28)
- Animal-Head Feet and a Bark-Beater in the Middle Usumacinta Region (27)
- Notes on the Sculpture and Architecture at Tonala, Chiapas (21)

Elsie McDougall:

A Vase from Sanimtaca, Alta Verapaz, Guatemala (30)

J. Eric S. Thompson:
- A Figurine Whistle Representing a Ball-Game Player (25)
- Representations of Tezcatlipoca at Chichen Itza (12)
- Representations of Tlalchitonatiuh at Chichen Itza, Yucatan, and at El Baul, Escuintla (19)
- Some Sculptures from Southeastern Quezaltenango, Guatemala (17)
- Observations on Glyph G of the Lunar Series (7)
- Maya Epigraphy: Directional Glyphs in Counting (20)
- Maya Epigraphy: A Cycle of 819 Days (22)
- The Initial Series of Stela 14, Piedras Negras, Guatemala, and a Date on Stela 19, Naranjo, Guatemala (18)
- The Prototype of the Mexican Codices Telleriano-Remensis and Vaticanus A (6)
- The Missing Illustrations of the Pomar Relación (4)

R. C. E. Long:
- The Payment of Tribute in the Codex Mendoza (10)
- A Note on Aztec Chronology (11)

R. H. Barlow: The Periods of Tribute Collection in Moctezuma's Empire (23)

Heinrich Berlin: Notes on Glyph C of the Lunar Series at Palenque (24)

Wilfredo du Solier: A Reconnaissance on Isla de Sacrificios, Veracruz, Mexico (14)

Isabel Kelly: Notes on a West Coast Survival of the Ancient Mexican Ball Game (26)

John Rowland Howe: A New Pottery Style from the Department of Piura, Peru (8)

A. M. Halpern: A Theory of Maya tš-Sounds (13)

The *Notes* are published by offset process on loose letter-size paper, and on only one side of the sheet. The formats of this first volume are open to some criticisms that need not be stressed, inasmuch as the faults have all been corrected in the first numbers of Volume II. The paper is thick and the tome bulky and heavy, nearly three pounds in weight and nearly an inch in thickness; either thinner paper or both sides should have been used. Four different formats were tried (and the second volume is in a fifth), as well as paper of slightly different stock and size; possibly the latter was unavoidable in these take-it-or-leave-it days. In the last of the four, comprising the final fifteen articles, insufficient margins were left, especially at the right and the bottom, probably an ill-advised means of saving paper.

Middle Americanists, especially those with short contributions writhing for birth, welcome this new series with enthusiasm.

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Philadelphia

Excavations at Tajumulco, Guatemala. Bertha P. Dutton and Hulda R. Hobbs. With appendices by T. D. Stewart on the skeletal remains and by William C. Root on objects of metal. (Monographs of the School of American Research, No. 9. xii+124 pp., 2 plates, 6 maps, 101 figures, bibliography, index. Santa Fe, 1943.)

This monograph records the investigation of an archaeological site in the Department of San Marcos, southwestern Guatemala. How warmly it will be welcomed by Middle Americanists can be realized if one considers that, with the exception of S. K. Lothrop's paper on a few trenches dug at Chukumuk on Lake Atitlan, there is not in print a single full report on any piece of excavation in the entire stretch of the highlands or the south coast of the Republic. The present contribution therefore begins the filling of a long-felt want, and does it with satisfying completeness and accuracy.

The Tajumulco ruins are situated in a narrow gorge on the slopes of the great volcano of the same name. The country thereabouts is rugged and offers little land suitable for agriculture. It is far less favorable than the hot, but marvellously fertile Pacific littoral just below, or the temperate, open intermountain basins to the northeast. The region could never have sustained a large population, and the site was presumably the ceremonial center for scattered groups comparable in numbers and in their simple way of life to the communities of Maya-speaking Mam farmers who inhabit the vicinity today.

The ruins, occupying a narrow tongue of land above the stream, consist of a series of flat terraces and two principal mounds, the latter on the north and south sides of a plaza in whose center is a large, low, square platform bearing a number of sculptured stones, some in their original positions, others moved there by the authorities.

Excavation revealed broad, slabbed stairways connecting the terraces and ascending the mounds. A trench cut into the south mound proved it to have grown by accretions of sand and rubble retained by walls of boulders. There were found three former summit levels, but no trace of superstructures remained. In the mound and elsewhere, usually at the foot of stairways, there came to light twenty-one more or less rectangular graves, each lined and covered with slabs. Practically all held offerings of pottery and other objects.

Although little architectural evidence was recovered, the finds of sculpture and pottery were numerous and important. The sculptures comprise a massive stone with a basin-like hollow in the top, the sides bearing human and animal figures; many boulders with similar representations; and several monolithic tripod and tetrapod stone altars of a type not hitherto reported. The carving is unfortunately too badly weathered for entirely successful recording by photography, and drawings, since made by Sr. Antonio Tejeda, were not received in time to be included in the report, but will shortly be published in *El Palacio*. When these appear it will be possible more intelligently to pass judgment upon the authors' belief that the work shows both Maya and Mexican influences, with features linking it with cultures of Chiapas, Vera Cruz, and the eastern Guatemala highlands (Kaminaljuyu). To the reviewer, the square human faces with rectangular mouth and nose in the form of an inverted T seem strongly to resemble certain jade and other small stone carvings of the Quiché region.[1]

At all events, when we have Stirling's forthcoming report on the monuments of Izapa (just across the nearby Mexican border) and Thompson's on those of the Santa Lucia Cotzumalhuapa district, these monuments will fit most usefully into our growing corpus of information as to the distribution and the cultural significance of south Mexican and highland and coastal Guatemalan sculpture. The Tajumulco specimens are probably all assignable to a single period, for, although the authors believe it possible that certain buried walls may represent an older occupation, the reviewer thinks that if this were the case potsherds or figurines of the unmistakable earlier Guatemalan types could not have failed to appear, and to have been recognized by observers as keen as Miss Dutton and Miss Hobbs.

Long-inhabited sites, by providing stratigraphic evidence for the chronological ranking of cultures, are of the utmost value. But the monuments at such sites are often of widely differing age, while refuse deposits are inevitably more or less mixed. Hence one must turn to one-period ruins for pure representations of individual culture stages. And, as just intimated, Tajumulco has seemingly yielded a sample of exactly this sort. The material, too, dates from a period of unusual interest, one which, in Guatemala at least, has hitherto remained practically unknown.

[1] Cf. S. K. Lothrop, *Zacualpa. A Study of Ancient Quiche Artifacts*, Carnegie Institution of Washington, Publication 472.

The assigning of Tajumulco to its proper place in the sequence of Middle American cultures has been successfully accomplished by the authors on the basis of the artifacts from the graves. Among these were bells and a filigree ring of copper, a small gold disc, and seventy-odd pottery vessels, over half of which were plumbate—by far the largest and most comprehensive collection of this archaeologically important and technologically puzzling ware yet recovered by competent observers.

The copper objects indicate that the interments were made subsequent to the abandonment of the classic Maya cities of Peten about 900 A.D. (according to the Goodman-Martinez-Thompson correlation). Absence of Tiquisate ware and of the simple forms of plumbate found by Thompson to be associated with it at El Baul, suggest that some time must have elapsed between that date and the founding of Tajumulco, while the abundance of fully developed effigy plumbate, the presence of a fine-orange vase and several tripod bowls with animal-head feet serve to place that event in Thompson's "Mexican Period," which he considers to have lasted from about 1000 to 1250 A.D. The work of Miss Dutton and Miss Hobbs thus provides us with much information as to the town planning, burial customs, sculpture, pottery, and minor industries of what seems to have been a typical small community of about the twelfth century. The greatest immediate value of their paper lies, however, in its full and admirably illustrated section on plumbate pottery. This ware, having been very widely disseminated in trade, can be used to establish chronological linkages and to identify routes of commerce throughout large parts of Middle America. But for these purposes we need much more precise knowledge than we have hitherto possessed regarding both its composition, its decoration, and the place of its manufacture. Now, however, we have at least one large collection of pieces of known provenience. And all the plumbate material from Tajumulco has been made available to Miss Anna O. Shepard, who is preparing a comparative stylistic and technological study of the ware throughout its entire range.

A word of caution in closing this summary of an intelligently conceived, well executed, and admirably reported excavation: Miss Dutton and Miss Hobbs (p. 106) see, in vessel form and in design, influence upon plumbate from the ceramics of Totonac sites and sites of the Mixtec-Puebla cultures. The reviewer feels, however, that until the designs of all the wares in question have been much more thoroughly analyzed and until a great deal more is known regarding the sequence and the age of the several cultures that evidently once existed both in Vera Cruz and Puebla, it is unsafe to make postulations of this sort. Once in print, unless very emphatically labelled as highly speculative, they all too readily receive acceptance as ascertained fact.

In Appendix I, Dr. Stewart describes the skeletal material. As he points out, the excavators of Tajumulco gave more care to the human remains than Middle American archaeologists often accord the badly rotted bones usually found in that area, with the result that enough of one skull was recovered to permit partial reconstruction and determination of the fact that it had undergone fronto-vertico-occipital deformation, a type less common in this area than the parallelo-fronto-occipital. The many teeth recovered showed little or no caries; lack of wear indicated that no individual lived past middle age. There was but one artificially altered tooth, an incisor apparently sawed to a single point. Dental mutilation was seemingly less common in highland Guatemala than in the lowland Maya area and in central Mexico. Among the scores of incisors found by the reviewer and his associates at Kaminaljuyu, near Guatemala City, there was also only one example of this practice.

In Appendix II, Dr. Root studies the copper objects from the Tajumulco graves. They proved to have been made by the cire-perdue process and to be of very pure metal, believed by Dr. Root probably to have emanated from Chiapas or the Guatemala high-

lands, as most specimens from Oaxaca to the north and western Honduras to the south contain impurities.

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Archaeological Reconnaissance in Campeche, Quintana Roo, and Peten. KARL RUPPERT and JOHN H. DENISON, JR. (Carnegie Institution of Washington, Publication 543. Washington, 1943.)

This volume supplies facts for the record. They were gathered by four Carnegie Institution expeditions into a section of Maya lowland country formerly unknown archaeologically. There are no formal conclusions, though a few deductions appear in Ruppert's short *Summary*. The district explored lies between the fairly well-known regions which used to be called "Old Empire" and "New Empire." The importance of the material presented can hardly be overestimated. The first expedition, in 1932, followed discovery of Calakmul by C. L. Lundell, and was in charge of S. G. Morley, with Ruppert as one of the party. Thereafter Ruppert was in charge, and the late John H. Denison, Jr. was the epigrapher. The authorship of the descriptive text is divided between these two.

Denison's *Description of the Monuments* can conveniently be considered first. There is a summarizing table of all dates read, which distributes eighty-eight Long-count positions among six of the twenty-eight sites visited. The epigraphic material for the site Calakmul, which alone accounts for fifty-six of them, is transcribed from Morley's notes. One gets the impression that elsewhere the readings are Denison's alone. But, since in two cases a differing Morley opinion is noted, one supposes Morley agrees with all the others. In the manner of Morley's *Inscriptions of Peten*, a single question mark is attached to ten readings in the table, and two question marks to four more, leaving seventy-four "sure" Initial Series or Period-ending dates. One should be on his guard against a doubtless unintentional failure to use these question marks in all cases where the same reading appears with other information on the monument concerned.

The monument-by-monument descriptions are in abbreviated tabulated form only, so that fifty-two pages suffice for them all. Morley's habit of supplementing such tabulations of conclusions with justifying comment is not here followed. I undertook to inform myself as to new material on the Supplementary or Lunar Series. According to my count there are sixteen "sure" moon-ages (Glyphs D-E), eight of them with sure moon-number readings (Glyph C), and five of these with sure twenty-nine- or thirty-day readings (Glyph A). Thirteen of the moon-age records are at the single site of Calakmul. This is a rich haul.

Denison has a short introductory note explaining his method of making rubbings, rather than drawings, of glyphs. A few of these are published beside photographs. But in general the reader is asked to accept the readings given without being able to check for himself, since only thirteen plates of monuments are provided. These supply photographs of eleven areas of glyph-blocks, four supplemented by published rubbings. A few glyphs appear in drawings which supplement photographs of the scenes on the monuments. The amount of raw Maya text material supplied for the use of others is therefore disappointing. It is especially so since the long discussions in the Morley manner are omitted. With the latter, one can generally form an opinion of the epigrapher's judgment in a particular doubtful case. It seems to me that the terse "take it or leave it" manner of presentation here used is admirable, but should only be employed when all of the actual Maya material interpreted is clearly reproduced with it. One hopes that someday

all Maya inscriptions, *especially* the doubtful damaged ones, will be reproduced with the same standard of clarity set years ago by Maudslay with his photographs of originals or of casts. In the meantime, if a theory collides with a supposedly sure reading in this volume, in most cases the theorist has no way of deciding whether he should scrap his theory or may instead justify a question-mark of his own for that particular reading.

The Long-count readings of dates supposedly "contemporary" with the carving of the monuments run from 8.18.9.17.18 to 10.3.0.0.0. They thus range over 178,402 days, or about 422 years, close to the maximum for the southern lowland sites as a whole. In his summary, Ruppert reviews the date-range (as known) at each site. Otherwise, this summary deals almost exclusively with architecture and the arrangement of buildings, as does his main text, *Description of the Ruins*. This reflects lack of much excavation. A number of metates were measured, and a new sub-type of these corn-grinding stones was identified.

It was on these expeditions that Ruppert extended the known distribution of a particular four-building arrangement which he discussed in *The Maya and Their Neighbors*. It had been supposed that this special assemblage functioned in making horizon observations for equinox and solstice dates. For convenience we might call the arrangement a "T assemblage." The theory called for an observer's station on one structure; thence he is supposed to have sighted to one of three specific points on as many structures, arranged on a north-south line lying to the east. He would see the sun rise behind the central of these three points on equinox days, and behind the northerly and southerly points on summer and winter solstice days, respectively. The same data are here presented more briefly. The complex at Benque Viejo is transferred to the group of questionable examples, and a similar conclusion stated somewhat more definitely. Ruppert does not think the assemblages considered "were erected for making a common set of astronomical observations. Nevertheless the obvious similarity in orientation and arrangement suggests their use for a common function, which in the original instance may have been astronomical but provincially and decadently became merely ritualistic."

Seven new ball-courts were found. The cross-section type of three was determined, and is what I would like to call the "sloping bench-top" type, with vertical walls rising from the alley to the bench, and from the rear of the bench toward the top of the structure. Ruppert notes that this type differs from courts at Piedras Negras and Yaxchilan. In the courts thus referred to, the bench-top is level, with a sloping surface rising to it from the alley, and with a more extensive apron-like sloping surface rising from its rear toward the top of the structure. This variety is what Blom described when he extended the recognized distribution of ball-courts to "Old Empire" territory. But the sloping bench-top type has also been excavated, by the reviewer, at Piedras Negras, though it is unpublished. Like Ruppert's examples, it lacked the ring and the alley-markers. Considering the cross section only, this type seems to be the rule in Maya country east of the Usumacinta, as for instance at Uaxactun and at Copan, and I understand it occurs in the Guatemala Highlands. As I see it, both types have their cousins, if not their blood-brothers, in Highland Mexico. A new and probably complex inter-regional problem begins to shape up.

It has been usual to suppose that the principle of the true arch was unknown to the American Indian, though here and there in some particular structure it has been argued that the principle, though not obvious, was really present. If the reader will turn to Figures 22 and 23 and Plates 3*b* and 4*a* of this report I believe he will have no doubt that the Maya at La Muñeca roofed a long room with the true arch, and that they knew exactly what they were doing. For text comment on this see pages 8 and 26.

The above three items are selected from many covered in the summary, as being likely to interest non-specialists at the present time. We have in this report a gold mine

which must be utilized whenever a problem touching Maya building activities is being attacked. The author has shown great interest and skill in making it readily available. There are eighty-two pages of site-by-site and group-by-group textual description. There are twenty-one site maps, fifteen of them large folded ones, and most of them with ground plans of some buildings. There are about seventy pages of line drawings apart from site maps. For the most part these give plans, sections, or elevations of structures or parts of them. There are three interesting groups of *graffiti*—incised drawings on plaster walls. The frontispiece is a rendered restoration drawing of a three-towered building of "Rio Bec" type, discovered at Xpuhil. This is by Tatiana Proskouriakoff, who, I understand, is making many similar reconstructions from field data of Carnegie Institution expeditions. In addition to all this, there are forty-seven plates of photographs dealing with buildings.

LINTON SATTERTHWAITE, JR.
University Museum
Philadelphia, Pennsylvania

A Selected Bibliography of American Indian Archaeology East of the Rocky Mountains. JOHN OTIS BREW. (Papers of The Excavator's Club, Vol. 2, No. 1. Cambridge, Massachusetts, 1943.)

This is a useful and well selected bibliography. Some of the subject matter is classified topically: *Early Man, Dendrochronology, Burial Customs*—to name only a few of the headings. But the majority of listings are merely arranged by state. In his introduction, Mr. Brew explains fully his epistemological approach to this particular bibliography, thereby disarming any carping reviewer.

The Louisiana Chamber of Commerce may be somewhat dismayed to learn that the Gahagan site[1] is in Texas rather than in Louisiana where it belongs. But to me this is a small matter. Had the Gahagan Indians lived forty miles to the westward, Brew would have been correct.

There are a few typographical errors which do not bother me in the least. For its purpose it is a good bibliography, and it is a good beginning toward a complete bibliography of archaeology in the eastern United States.

GEORGE I. QUIMBY, JR.
Chicago Natural History Museum

Pueblo Indian Embroidery. H. P. MERA. (Memoirs of the Laboratory of Anthropology, Vol. 4, 1943. Santa Fe, New Mexico. $4.50.)

Pueblo Indian Embroidery is an historical and technological study of the development of the art of embroidery among the Pueblo Indians from prehistoric to modern times. The work contains twenty pages of general discussion under the headings of *History, Possibilities of Origin, General Remarks on Design, Embroideries on Cotton, Embroideries on Wool,* and *An Explanation of the Drawings of Design.*

The historical section is divided into two parts, dealing with the periods before and after 1880. The former includes a study of the art background and of the possible origins. Both views concerning the origin of Pueblo Indian embroidery are considered, namely, that the art is pre-Columbian, and that it is a result of European influence.

The section dealing with the post-1880 period traces the changes which took place when the railroads made machine-made fabrics accessible to the Pueblo territories.

[1] C. H. Webb and M. Dodd, Jr., "Further Excavations of the Gahagan Mound; Connections with a Florida Culture," *Texas Archaeological and Paleontological Society,* Vol. 11, 1939, pp. 92–126.

These imports supplemented the hand-made work and caused a general deterioration not only in weaving and embroidery but also in art style. The sections dealing with embroideries on cotton and wool present a picture of the situation as it existed prior to the introduction of sheep and of the effect that this animal had on earlier techniques. The effect of the Spanish on both technique and design is also considered under these headings. Of particular interest is the suggestion that many of the characteristics of modern Pueblo embroidery had their origins sometime previous to the fifteenth Century.

Because of the rarity of examples of true embroidery the author has drawn on a wide variety of sources for the materials on which his study is based. These materials are well illustrated. There are twenty-six plates, of which three are in color. Facing each is an explanation, discussion, and description of the design and technique. A color key accompanies each black-and-white design. Mr. Stanley Stubbs deserves great credit for his excellent photographic work.

This memoir is a definite contribution to an understanding of American Indian art and should be a help to students of design. Two possible suggestions for further study might be included. It would be interesting, first, to determine the effect that the modern Indian school has had and is having on Indian embroidery, and, second, to discover, if possible, what influence porcupine quill work might have had on the origin or development of textile embroidery among the Pueblos.

JACK R. DYSON
University of New Mexico

Chetco Archaeology. JOEL V. BERREMAN. (General Series in Anthropology, No. 11, 40 pp., 7 figures, 10 plates. Menasha, Wisconsin. 1944.)

Since the pioneer probings of Schumacher along the Oregon coast in 1873, little or no archaeological research had been attempted in the area described in this report until Berreman's excavations, first began in 1935. This monograph is likely, therefore, to serve for many years as one of the basic handbooks for students of Oregon coast prehistory.

The site selected for excavation is a shell mound on the south bank of Lone Ranch Creek at the point where it enters the Pacific Ocean, roughly twelve miles north of the California boundary. Two smaller shell deposits a mile south of the Lone Ranch Creek site were sampled. These sites are in the northern portion of the area considered Chetco territory.

The mound deposit, ten feet in thickness at its greatest depth, was composed of three major strata of varying regularity and thickness. The major portion of the two lower strata was shell, the surface stratum was a uniform mixture of shell and sand. Fire sites, artifacts, house floors and other evidences of habitation occurred in all three levels. The primary excavation was a trench, five feet in width and 215 feet in length running north and south through the center of the deposit and intersected by a similar trench running from the western edge of the deposit to the center. Although supplementary trenches were of course made, a greater excavated area of the total deposit appears desirable. It is regrettable that the shortness of time or similar exigencies should necessitate the use of a team and Fresno scraper for excavating, particularly in the main mass of a deposit such as this one where burials as well as artifacts occur without even the warning of uniformity of position.

Following a description of the composition of the mound the human remains are described. This includes a description of 34 burials with their associated artifacts, synthesized in a table, and an anthropometrical description with three tables one of which compares indices of the Lone Ranch Creek crania with California crania. With due

allowance for variation, Berreman demonstrated that the Lone Ranch Creek crania are within the range of variability of the general Californian type described by Gifford.[1]

A detailed description of the cultural objects is well illustrated with six plates. This is further supported with a table showing the vertical distribution of the artifacts. The problems of stratigraphy and distribution were not extensively developed. Occasional suggestions, however, of the age of the site and cultural sequences are presented. The presence of grinding slabs, for example, and the absence of mortars indicates that the site is of no great antiquity for the grinding slabs, a California influence, replaced the mortar in northern California sites. Artifacts from both California and from the north occur together from the lowest level. The similarity of these artifacts to those of northern California together with the cranial type which is identified as a local variation of the Californian type indicate the close relationship of the Chetco to the tribes of northern California.

Greater elaboration in the comparison of elements found here with those of other areas is desirable. Useful comparisons could have been made with elements found at a shell deposit near the mouth of the Coquille River.[2] Although comparisons are made to other elements found with burials at Gold Hill, Oregon, there is none concerning pipes, of which good specimens were found at either site.[3]

One of the most useful divisions of this monograph is devoted to a comparison of materials with ethnological information. In this is a table comparing elements found at the Lone Ranch Creek site with 113 elements drawn from Barnett's ethnological study of the Chetco.[4] Agreements are found on 57 elements and opposite findings on 32. Of the opposite findings 17 are elements reported present by Barnett but not found in the Lone Ranch Creek site, more extensive excavation of the site might have uncovered some of these. Berreman gives an excellent analysis of the disparity between his findings and those of Barnett which he attributes primarily to (1) nature of archaeological evidence which is often fragmentary and capable of misinterpretation, (2) possibility that the site may belong to a period prior to that known by Barnett's informants, (3) local variations in culture.

This monograph is certainly a substantial contribution to the prehistory of the Oregon coast. It is well written, possesses good organization and is thoroughly illustrated.

WILLIAM S. LAUGHLIN
Redwood Ranger Station
Cave Junction, Oregon

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[1] Gifford, E. W. *Californian Anthropometry*. (University of California Publications in American Archaeology and Ethnology, Vol. 22, No. 2, 1926.)

[2] Leatherman, K. E., and Krieger, A. D. "Contributions to Oregon Coast Prehistory" (American Antiquity, Vol. VI, No. 1, pp. 19–27, 1940).

[3] Cressman, L. S. "Aboriginal Burials in Southwestern Oregon," (American Anthropologist, N.S., Vol. 35, pp. 116–30, 1933).

[4] Barnett, H. C. Culture Element Distributions: VII—Oregon Coast (Anthropological Records, University of California, Vol. 1, No. 3, 1937).

SOCIETY FOR AMERICAN ARCHAEOLOGY

ANNUAL MEETING—1944

The ninth annual meeting of the Society for American Archaeology was held on May 13, 1944, at the Cosmos Club in Washington, D. C. The business meeting was called to order by Dr. W. D. Strong, First Vice President, at 1:15 P.M., with 33 persons present.

The actions taken by the Executive Committee in lieu of the eighth annual meeting in 1943 were approved as printed in AMERICAN ANTIQUITY, Vol. IX, No. 2, October, 1943, p. 260.

The reports of the Secretary, Treasurer, Auditing Committee and Editor, as published below, were read and approved. A rising vote of appreciation was given the Treasurer in recognition of his able services in reorganizing the Society's accounts. The budget for 1944–45 was adopted, after short discussion, as read.

In the absence of the chairman of the Nominating Committee, W. C. McKern, the Secretary read the report of the committee as received from the chairman under date of February 2, 1944:

President: J. Alden Mason
1st Vice President: W. S. Webb
2nd Vice President: Eduardo Noguera
Council members: Eli Lilly, C. R. Keyes (1944–1948)

There being no nominations from the floor, the above nominees were elected *viva voce*. The Secretary, Treasurer, and Editor were elected in 1943 for 4-year terms.

As matters of new business, Mr. Frederick Johnson proposed that Miss Evelyn Willett be appointed Assistant to the Treasurer, with power to receive and disburse Society funds during the Treasurer's temporary absence from the country. This matter was referred to the Executive Committee, which in a meeting following the program of papers, approved Mr. Johnson's suggestion.

The matter of affiliating with other scientific societies was also raised, and referred to the Executive Committee. After some discussion, the Executive Committee voted for affiliation with the Inter-American Society of Anthropology and Geography.

Immediately following the business meeting the following papers were read and discussed:

1. Early Man in California and the Tranquillity Site—Gordon W. Hewes.
2. The Significance of Fibre-tempered Pottery of the Florida East Coast—James B. Griffin.
3. The Position of the White-on-Red Horizon in Andean Archeology—Gordon Willey.
4. The De Luna Expedition and the "Buzzard Cult" in the Southeast—James E. Griffin.

The evening session was called to order shortly after 8 P.M. by Doctor Strong. It was attended by approximately 30 persons, with the Anthropological Society of Washington generously providing refreshments. Discussion revolved about the future of archaeology, with emphasis on the need and means for a stock-taking of available resources (unpublished collections, manuscripts, etc.) and their utilization by qualified students. It was pointed out that the extensive collections amassed through large scale Federal relief archaeology are, with few exceptions, either still unreported or are in a form that makes them unavailable to workers in adjoining areas. Since the location and extent of a great many of the relief projects, and the present status of material so derived, are not matters of common knowledge, it was suggested that a committee be appointed by the Society for American Archaeology to examine and evaluate the quarterly progress reports and summaries of Work Projects Administration projects deposited in the Department of Anthropology, U. S. National Museum. The priority rights of sponsors and directors of these projects were clearly recognized; nevertheless, it was felt that serious consideration should be given to the possibility of publication of a general descriptive summary setting forth the geographic location of sites worked, extent of investigations, sponsor and supervisory personnel, disposition and accessibility of collections, and status of manuscripts or publications resulting from the work. With this information it would then be possible for a worker in another area to contact individuals or institutions whose collections and unpublished work gave promise of bearing on inter-areal problems.

It was also recommended that the Society go on record as favoring the withholding in future of any possible public relief funds for field investigations from institutions and organizations unless and until they have fulfilled by publication their contractual and moral obligations from past Federal grants.

To implement the above recommendations, the suggestion was also made that the Society establish a committee to work in conjunction with the Committee on Basic Needs in American Archaeology of the National Research Council; and that this or a similar group representing the Society be made a permanent policy committee to consider whatever problems of policy may arise in connection with post-war archaeology.

WALDO R. WEDEL

REPORT OF THE SECRETARY

The eighth annual meeting of the Society for American Archaeology, tentatively proposed for July, 1943, was cancelled in accord with the request of the Coordinator of Transportation. The business matters that would normally have been considered at this meeting were transacted, by mail, by the Executive Committee in accord with Article IV, Sections 4 and 5 of the Constitution. A report on these transactions, which

are still to be approved by the Society in annual meeting, was published in AMERICAN ANTIQUITY, Vol. IX. No. 2 (October, 1943), p. 260.

During the past year, 1943–44, President Haury appointed the following committees, as provided by the Constitution:

Budget Committee: E. W. Haury, W. R. Wedel, Frederick Johnson, Douglas S. Byers, N. C. Nelson, A. T. Hill, J. B. Griffin.

Auditing Committee: Leaman F. Hallett, Chairman, Roger Wilson, Maurice Robbins.

Nominating Committee: W. C. McKern, Chairman, Neil M. Judd, Glenn A. Black.

Program Committee: Douglas Byers, Chairman, A. V. Kidder, Frederick Johnson.

Committee on Local Arrangements: F. M. Setzler, Chairman, Neil M. Judd, W. R. Wedel.

As in the preceding year, and for the same war-connected reasons, no special, joint, or regional meetings of the Society were authorized by the Executive Committee in 1943–44.

On behalf of the Society, the President read a letter of greeting to the Third Round Table Conference of the Sociedad Mexicana de Antropologia in Mexico City in August, 1943.

Respectfully submitted,

WALDO R. WEDEL

REPORT OF THE TREASURER

ACCOUNT OF MEMBERSHIP

	Changes in membership during fiscal year 1942–43								Type of account				
	5/1/43	New Members	Resigned	Dropped—no address	Dropped—arrears in dues	Duplicate accounts removed	Deceased	Number 4/30/44	Fiscal	Calendar	Prepaid[5]	Exchange	Complimentary
Benefactor & Honorary	0							0					
Life Members	11							11					
Institutional Members	126	11	2		1	3		132	82	46	4	10	4
Active Members	617[1]	48	9	8[2]	58[3]	2	3[3]	586[4]	567	1	18		3

[1] These figures represent a correction of figures published in AMERICAN ANTIQUITY, Vol. IX, No. 2. It is believed that the present figures are as accurate as the previous records permit.

[2] One member in Armed Services.

[3] Two members in Armed Services. Number entering Services unknown.

[4] Seventy-six members in Armed Services.

[5] Most of these are fiscal year accounts.

[6] Membership transferred.

WORKING FUND

Analysis of Income from Membership 1943–44

652 members pd. $4.00 each	$2,608.00	
45 members pd. $2.00 each (calendar year)	90.00	
10 members, dues prepaid, pd. $1.00 each	10.00	
	$2,708.00	
Beginning Balance Forward 5/1/43		$ 947.64
Cash Received		
Dues & Subscriptions		
Prior years	$ 3.00	
1943–44	2,708.00	
Prepaid	238.70	
	$2,949.70	

Contributions		$ 640.00	
Sale of AMERICAN ANTIQUITY		187.25	
Receipts for Reprints		528.14	
Reimbursement for Illustrations		490.05	
Sundry: Sale NOTEBOOK, Reimbursement for Collection & Bank Charges, etc.		40.87	
Total Cash Received			$4,836.01
Total			$5,783.65
Cash Paid			
Publishing AMERICAN ANTIQUITY			
Printing	$1,951.68		
Illustrations	746.68		
Distribution	88.29		
Reprints	390.26		
		$3,176.91	
Editor's Account		256.41	
Treasurer's Account		201.24	
Sundry			
Secretary's Acct.	$13.76		
Miscellaneous	15.35		
		29.11	
			3,663.67
Total Cash on Hand 4/30/44			$2,119.98
Accounts Receivable			
Miscellaneous items		$ 122.90	
Irregular & Foreign dues a/c		$17.30	
			140.20
			$2,260.18
Accounts Payable			
Reprints brought forward from 11/2/42		$ 2.17	
Publishing AMERICAN ANTIQUITY, Vol. IX, No. 4, estimate		600.00	
Cost Annual Meeting		75.00	
			677.17
Balance Forward			$1,583.01

PERMANENT FUND

Brought Forward	$ 587.30	
10/15 Interest	5.87	
4/15 Interest	5.93	
Balance Forward	$ 599.10	

Resources

Cash on Hand	2,119.98
Permanent Fund	599.10
Accounts Receivable	140.20
	$2,859.28

Liabilities

Dues prepaid	238.70
Accounts Receivable	140.20
Accounts Payable	677.17
Permanent Fund	599.10
Free Cash	1,204.11
	$2,859.28

Distribution of Funds

Checking Account Andover National Bank	$2,119.98
Savings Account (Permanent Fund) Andover Savings Bank	599.10

REPORT OF AUDITING COMMITTEE

The undersigned, appointed as Auditing Committee, report that they have examined the Treasurer's accounts, as submitted for the fiscal year 1943, and find them correct.

LEAMAN F. HALLET, *Chairman*
ROGER H. WILSON
MAURICE ROBBINS

REPORT OF THE EDITOR

During the past year, four issues of AMERICAN ANTIQUITY have appeared with customary irregularity. As noted in an earlier issue, a combination of circumstances both in the press and in the Editor's office has contributed to our failure to maintain a regular schedule. Although we have hopes of attaining a closer approximation to our release dates in future issues, we are none too sanguine on that score.

The volume just closed, Volume IX, consisted of 472 pages, and was thus a larger volume than any which have yet appeared. A limitation order of the Pulp and Paper Division of the War Production Board set the weight of paper which may be used in publishing AMERICAN ANTIQUITY as 45 pound basis weight as compared with a paper of approximately 75 pound basis weight used in the first eight volumes. Because an earlier limitation order had specified that the poundage of paper to be used in 1943 was not to exceed that used in 1942, the decrease in the weight of the paper paradoxically permitted us to publish more pages than would otherwise have been possible. For the calendar year 1944 our paper quota is set at 3,049 pounds which will permit the publication of four issues as large as those contemplated in the budget, and in addition an extra number of the same size. If a suitable manuscript can be located, and if funds should be available, it would therefore be possible to publish a Memoir without an appeal to the WPB for extra paper.

The first number of Volume IX was devoted entirely to articles dealing with subjects from south of the Rio Grande.

We were privileged to secure articles from three of our colleagues who live in other American republics. In this connection, it seems only courteous to permit authors to choose between their native language and English for the expression of their thoughts. Accordingly, we have accepted articles written in Spanish for this and other issues. When such articles appear, briefs or translations of the original will appear at the same time. Since no complaints were received following the publication of the July issue, it would seem that this policy is not antagonistic to members.

The July number, also, was the largest number yet published, and was more copiously illustrated. This was made possible by subsidies from individual authors and the Institute of Andean Research.

The backlog of manuscripts has been considerably reduced, and the time is fast approaching when the file of manuscripts will be completely current. A sufficient number is still on hand to permit the publication of two issues over and above those already in process. Facts and Comments and Book Reviews are now completely current.

Respectfully submitted,
DOUGLAS S. BYERS, *Editor*

May 2, 1944

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INFORMATION FOR AUTHORS

AMERICAN ANTIQUITY is concerned primarily with archaeological matter, but articles dealing with related fields may be accepted providing that their connection with the archaeological field is clear. Manuscripts must be typewritten on standard 8½×11 paper, on one side only, double spaced. Articles should not exceed a length of 7500 words without subsidy by the author.

Bibliographies must follow a standard form; citations from journals should be given as follows:

JENKS, ALBERT E. AND LLOYD A. WILFORD.
1938. "The Sauk Valley Skeleton." *Bulletin of the Texas Archeological and Paleontological Society*, Vol. 10;

citations of separate books or reports:

JENKS, ALBERT E.
1936. *Pleistocene Man in Minnesota*. University of Minnesota Press.

Illustrations over and above one page of half tones or the equivalent in line cuts must be paid for by the author. Photographs for reproduction should be on glossy paper, unmounted, and of a size suitable for reduction to 4½×7 inches, or a portion thereof, making due allowance for captions. Line drawings should be in India ink on a smooth, hard-surfaced paper, with figure numbers written lightly in pencil on the margin or back.

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75 "	2.75	4.40	6.90	7.25	9.40	10.90	12.65	13.50
125 "	3.25	5.15	8.15	8.75	11.15	13.15	15.40	16.50
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